

BIOLOGY WORKSHOP 1 - UNDERSTANDING LIVING THINGS

SEYMOUR ROSEN

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Rosen, S. (1998) Biology Workshop I
Globe Book Co., New Jersey

AIM | How do we know when 1 something is alive?

Is your desk alive? Of course not! Does it eat? Does it breathe? Does it move or grow? Can it have babies?

Living things are called organisms [OR guh niz umz]. You know that plants and animals are living things. But, how do you know this? You know this because living things perform certain life functions [FUNGK shuns]. Life functions are all the things that living things do to stay alive.

Here is a list of the life functions:

INGESTION [in JES chun] The taking in of food. Ingestion is also called nutrition [new TRI shun].

DIGESTION [dy JES chun] The breaking down of food to a form that can be used for the life functions.

RESPIRATION [res puh RAY shun] The release of energy by combining oxygen with digested food.

EXCRETION [ek SKREE shun] Getting rid of waste products.

CIRCULATION [sur kyuh LAY shun] The movement of useful products to all parts of an organism and the carrying away of waste products. Circulation is also called transport.

RESPONSE TO STIMULI [STIM yuh lie] Reacting to changes in the environment. For example, a sudden loud noise can cause you to jump.

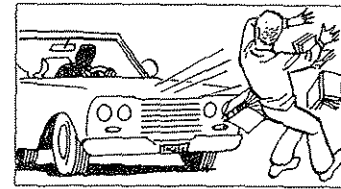
MOVEMENT All living things can move. The movement of a total organism from place to place without outside help is called locomotion [lo kuh MO shun].

GROWTH AND DEVELOPMENT Getting bigger and getting older.

REPRODUCTION [ree pruh DUK shun] Creating new life. Making more of one's own kind.

Only living things perform the life functions. Nonliving things do not perform any life functions. How many of these life functions will you perform during your lifetime?

WHICH LIFE FUNCTION? Which life function do you see in each picture? Write the life function on the line below the picture. (Continued on page 4)



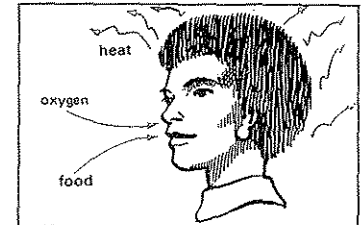
1. _____



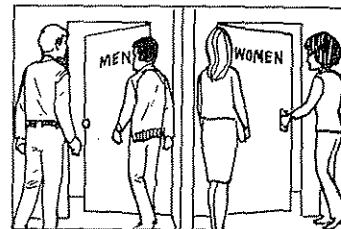
2. _____



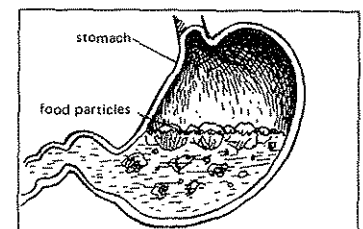
3. _____



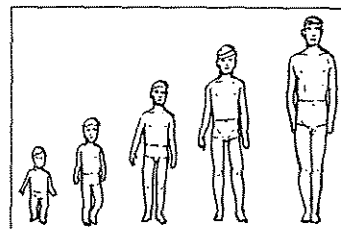
4. _____



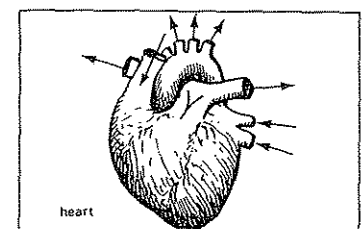
5. _____



6. _____



7. _____



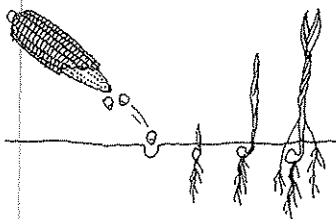
8. _____



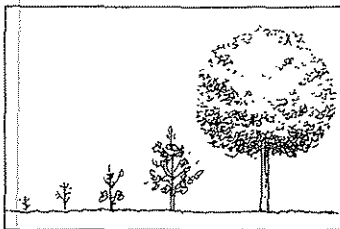
9. _____



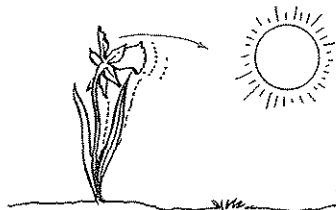
11. _____



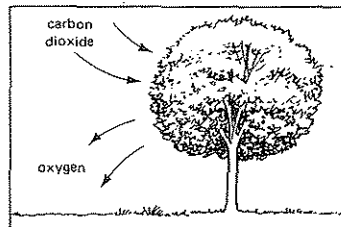
13. _____



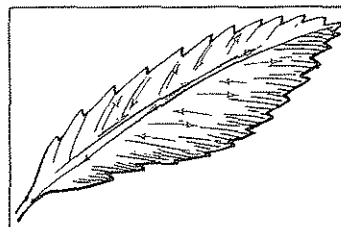
15. _____



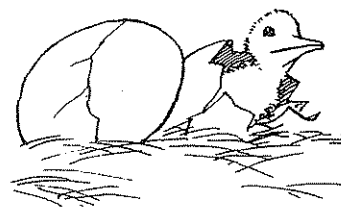
10. _____



12. _____



14. _____



16. _____

MATCHING Match the two lists. Write the correct letter on the line next to each number.

- | | |
|-------------------------------|--|
| 1. _____ ingestion | a) changing from a baby to a grown-up |
| 2. _____ digestion | b) movement of an entire organism without outside help |
| 3. _____ respiration | c) reacting to something |
| 4. _____ circulation | d) all are necessary for living |
| 5. _____ excretion | e) moving products inside the body |
| 6. _____ response to stimulus | f) changing food to a useful form |
| 7. _____ locomotion | g) supplies the energy for the life functions |
| 8. _____ growth | h) eating |
| 9. _____ reproduction | i) getting rid of waste materials |
| 10. _____ life functions | j) producing new offspring |

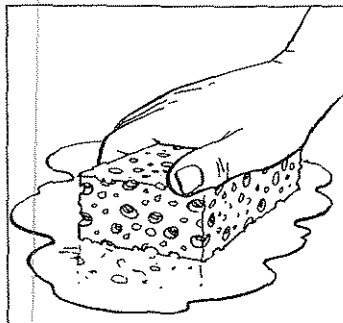
TRUE OR FALSE Write T on the line next to the number if the sentence is true. Write F if the sentence is false.

- | |
|---|
| 1. _____ The life functions happen only in living things. |
| 2. _____ Plants carry out all the life functions. |
| 3. _____ Digestion comes after ingestion. |
| 4. _____ Excretion moves digested food through the body. |
| 5. _____ Some living things never grow. |
| 6. _____ Plants reproduce. |
| 7. _____ Plants carry out respiration. |
| 8. _____ Plant leaves never move unless moved by something. |
| 9. _____ A sudden loud noise is a kind of stimulus. |
| 10. _____ Pulling a hand away from a flame is an example of a stimulus. |

WHAT'S HAPPENING?

Four pairs of pictures are shown below. Study each pair. Then answer the questions below the pictures.

I.



A.

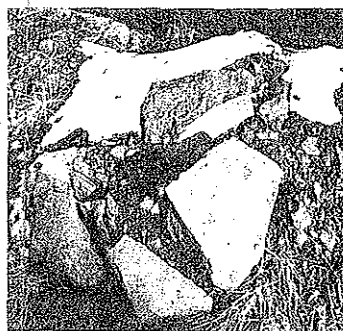


B.

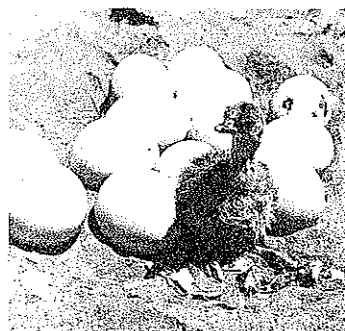
1. a) What is happening in A? _____
- b) What is happening in B? _____

2. a) Which picture shows a life function? _____
- b) name that life function. _____

II.



A.

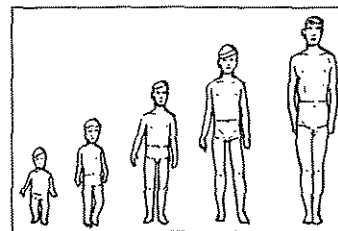


B.

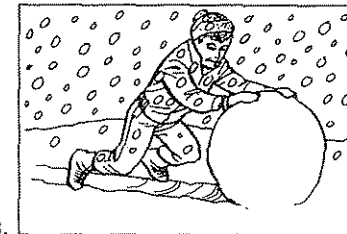
1. a) What is happening in A? _____
- b) What is happening in B? _____

2. a) Which picture shows a life function? _____
- b) Name that life function. _____

III.



A.



B.

1. a) What is happening in A? _____
- b) What is happening in B? _____

2. a) Which picture shows a life function? _____
- b) name that life function. _____

IV.



A.



B.

1. a) What is happening in A? _____
- b) What is happening in B? _____

2. a) Which picture shows a life function? _____
- b) Name that life function. _____

REACHING OUT How are these things different? Use the life functions to tell how they are different.



HINT:

Some things are living.
Some things are nonliving.
Some things are dead.



WHAT ARE INGESTION AND DIGESTION?

	2
	stomates: tiny holes in the leaves of plants ingestion: taking in food digestion: the breaking down of food into a usable form

AIM | What are ingestion and digestion?

2

All living things must have food and water. Food provides the energy and important chemicals an organism needs to carry out the life functions.

INGESTION

An animal cannot make its own food. Animals must take in food and water from the outside. This life function is called ingestion.

Think about the way you eat. Does your body make its own food?

Plants are different. Plants do not take in their food from the outside. Most plants can make their own food.

HOW PLANTS MAKE THEIR OWN FOOD

Green plants make their own food in their leaves. The food is made from only two substances—water and carbon dioxide gas. Light energy also is needed.

- Water enters a plant through its roots.
- Most carbon dioxide enters a plant through tiny holes in its leaves called stomates.

When plants make their own food, oxygen is given off. Plants use some of this oxygen. Most of the oxygen, however, goes into the air. Much of this oxygen is taken in and used by animals. Animals, in turn, give off carbon dioxide. This carbon dioxide is used by plants for food-making.

When you think about it, its amazing how much plants and animals need one another.

DIGESTION

Both plants and animals must digest their food. Digestion changes food to a form the organism can use.

Plants and animals make special chemicals that change the chemical make-up of food. They also change solid food to a liquid. Solid food must become a liquid before it can be used.

In many animals, digestion takes place mostly in the stomach and the small intestine. In most plants, digestion takes place where the food is made—in the leaves.

WHAT'S HAPPENING?

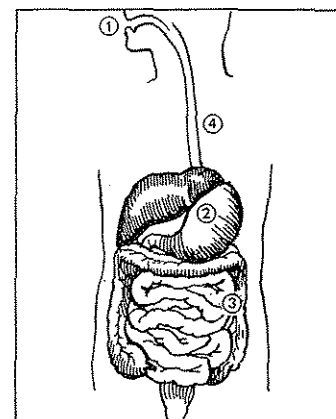


1. What life functions are shown here? _____
2. How are the pictures alike? _____

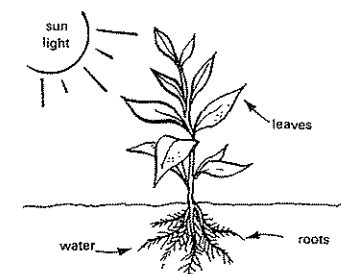
FIND THE PARTS

1. Find each part in the picture. Write its number on the correct line below.
3. Which part of a plant takes in water?

- a. _____ stomach
- b. _____ mouth
- c. _____ intestines
- d. _____ food pipe



2. In which two parts of an animal does much of the digestion take place?



4. Where does carbon dioxide enter a plant? _____
5. Plants make food from water and carbon dioxide. What else is needed? _____
6. In which part of a plant is food made? _____
7. In which part of a plant does most of the digestion take place? _____

COMPLETING SENTENCES

Complete the sentences with the words below.

stomach
makes its own
does not
carbon dioxide
ingestion

light
food
chemicals
mouth
leaves

water
digestion
small intestine

- Every living thing must have water and _____ to live.
- Taking food in from the outside is called _____.
- Most animals ingest food through a _____.
- A plant _____ ingest food.
- A plant _____ food.
- A plant makes food from _____ with _____ present.
- Changing food to a usable form is called _____.
- Food is digested by special _____.
- In your body, most digestion takes place in the _____ and _____.
- In plants, most digestion takes place in the _____.

MATCHING

Match the two lists. Write the correct letter on the line next to each number.

- | | |
|--|-------------------------------------|
| 1. _____ stomates | a) digest food |
| 2. _____ ingestion | b) a plant's food factory |
| 3. _____ water, carbon dioxide, and sunlight | c) tiny holes in leaves |
| 4. _____ chemicals | d) needed by plants for food-making |
| 5. _____ leaf | e) taking in food |

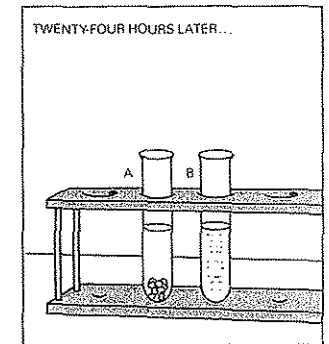
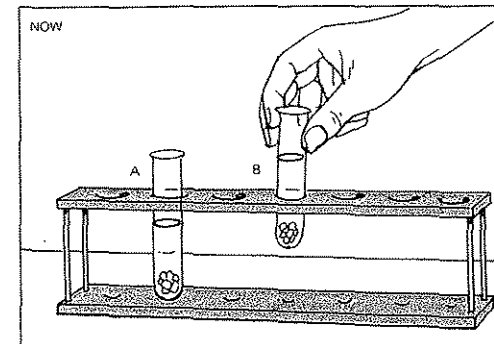


SHOWING HOW CHEMICALS DIGEST FOOD

What You Need

two test tubes
test tube rack
water

digestive chemical
egg white from a hard-boiled egg



How To Do The Experiment

- A.
- Place a piece of egg white from a hard boiled egg in a test tube. Add water. Label this test tube "A."
 - Place the tube in the rack.
- B.
- Place another piece of egg white in a second test tube. Add water. Then add the digestive chemical. Label this test tube "B."
 - Place the tube in the rack.
- Let both test tubes stand overnight.

What You Learned

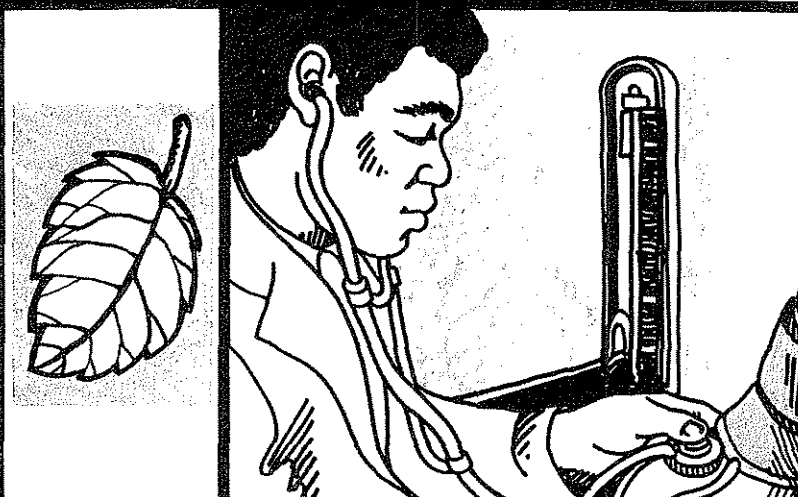
1. The egg white in test tube "A" _____ change.
did, did not
2. The egg white in test tube "B" _____ change.
did, did not
3. Digestion is taking place in test tube _____.
A, B
4. The egg white is changing to a _____.
solid, liquid
5. Water alone _____ digest food.
does, does not
6. What is in test tube "B" that is not in test tube "A"? _____
7. Which life function is happening in test tube "B"? _____

TRUE OR FALSE Write T on the line next to the number if the sentence is true.
Write F if the sentence is false.

1. _____ Some animals can live without food.
2. _____ Animals must ingest food.
3. _____ Plants ingest food.
4. _____ Plants take in carbon dioxide through the leaves.
5. _____ A plant takes in water through the leaves.
6. _____ Ingestion is the same as digestion.
7. _____ When food is digested, it changes to a liquid.
8. _____ After digestion, a steak is still a steak.
9. _____ Every living thing has a stomach.
10. _____ In plants, most digestion takes place in the leaves.

WHAT IS CIRCULATION?

3



circulation: the movement of useful products to all parts of an organism and the carrying away of waste products

blood vessels: tubes in an animal's body through which blood circulates

sap: the liquid that carries out circulation in plants

AIM | What is circulation?

3

To *circulate* means to move. Your blood moves throughout your body. It flows through tubes called *blood vessels*.

Place your right hand near the center of your chest. Can you feel your heart beating? Each time your heart beats, it is pumping blood throughout your body.

This movement of blood is very important. Blood carries digested food to all parts of the body. It also carries other substances the body needs—like oxygen and important chemicals.

Blood does even more. It also carries away harmful waste products that the body doesn't need. For example, blood helps to remove carbon dioxide and waste heat from the body.

The carrying of useful products to all parts of the body and the removal of waste products is called *circulation*.

A plant does not have blood or a heart. But circulation takes place in plants, also.

Circulation in plants is carried out by a liquid called *sap*. Pressure between the roots of a plant and its leaves causes the sap to flow.

Sap does the same job for plants that blood does for animals. Sap carries useful materials (such as digested food) to all parts of a plant. It also carries away harmful waste products.

WHAT DO THE PICTURES SHOW?

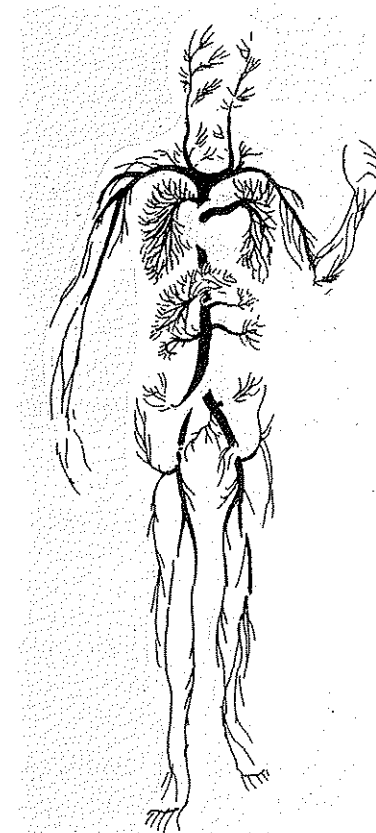
Look at each picture. Then answer the questions next to each picture.

In most animals, materials are carried by the blood.

1. What pumps the blood? _____
2. What are the tubes called in which blood moves? _____

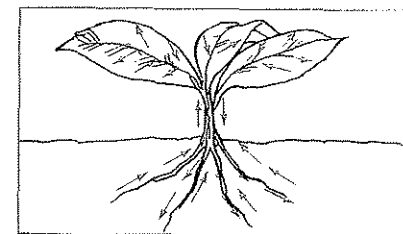
The human body has many blood vessels. Large blood vessels coming from the heart branch off into smaller and smaller ones.

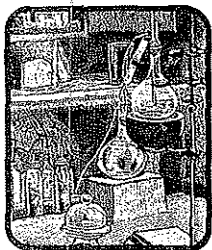
The blood then carries oxygen, digested food, and other useful substances to all parts of the body.



In plants, materials are carried by the sap.

1. Does a plant have a heart? _____
2. What moves the sap? _____





SHOWING HOW LIQUID MOVES IN PLANTS.

What You Need

stick of celery

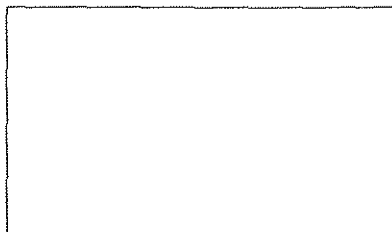
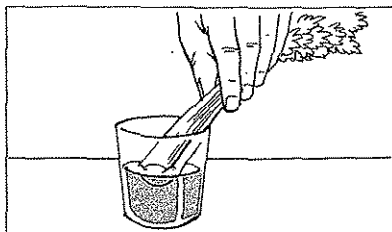
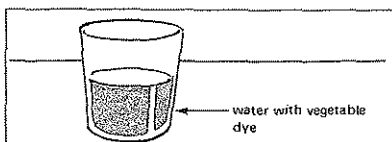
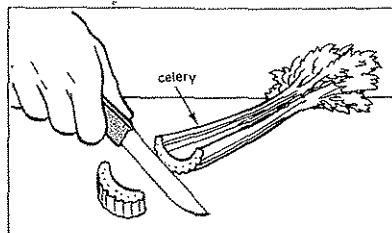
water

vegetable coloring



Sharp Objects

How To
Do The
Experiment



1. Take a piece of fresh celery. Cut off a small piece from the bottom. (wide end)
2. Half fill a glass with water. Put in a few drops of vegetable coloring.
3. Place the celery into the glass (wide end down).
4. Let stand overnight. Observe what happens.
5. Draw a picture of what you see in the space to the right.
6. What life process does this show?

COMPLETING SENTENCES Complete the sentences with the words below.

digested food
heart
pressure

blood
circulation
dies
oxygen

waste products
blood vessels
water
sap

1. The moving of materials in living things is called _____.
2. Two useful things that are circulated in all living things are _____ and _____.
3. Harmful materials made by an organism are called _____.
4. In plants, circulation is carried out by a liquid called _____.
5. Sap moves because of _____ between the leaves and roots.
6. In most animals, circulation is carried out by a liquid called _____.
7. The _____ is a living pump that circulates blood.
8. Blood moves through tubes called _____.
9. Take a guess! Blood is mostly _____.
10. If circulation stops, an organism _____.

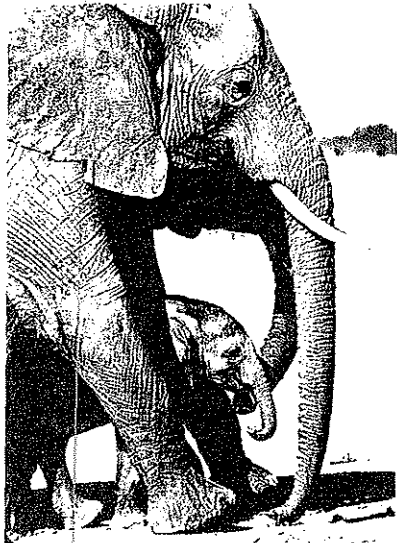
MATCHING Match the two lists. Write the correct letter on the line next to each number.

- | | |
|--------------------------|---|
| 1. _____ circulation | a) materials needed by every living thing |
| 2. _____ oxygen and food | b) can poison an organism |
| 3. _____ heart | c) is to plants what blood is to animals |
| 4. _____ waste products | d) the movement of materials |
| 5. _____ sap | e) a living pump |

ROBIN—570 beats per minute

DIFFERENT ANIMALS HAVE DIFFERENT HEARTBEATS

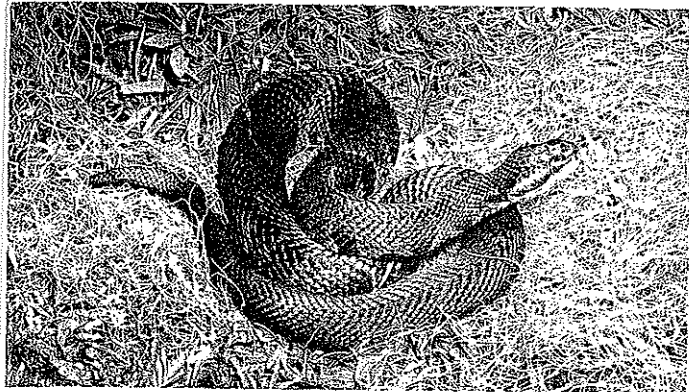
ELEPHANT—25 beats per minute



MOUSE—1,000 beats per minute



SNAKE—20 beats per minute

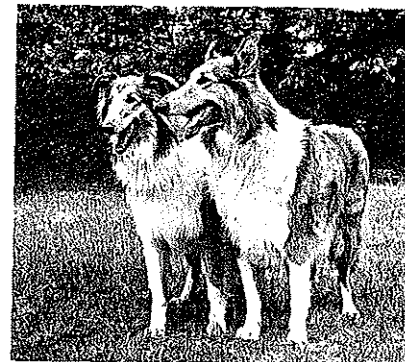


COW—65 beats per minute

CAT—120 beats per minute



DOG—100 beats per minute



HORSE—38 beats per minute



TRUE OR FALSE Write T on the line next to the number if the sentence is true.
Write F if the sentence is false.

1. _____ Digested food stays in the stomach and intestines.
2. _____ Only animals need oxygen.
3. _____ Circulation moves only useful materials.
4. _____ Only animals make waste products.
5. _____ Special parts of an organism get rid of waste products.
6. _____ Animals have sap.
7. _____ Sap is a liquid.
8. _____ Some plants have blood.
9. _____ Only animals have blood vessels.
10. _____ A heart is a pump.

REACHING OUT Why does a person die when his heart stops beating?

WHAT ARE RESPIRATION AND EXCRETION?

4



respiration: the getting of energy from the link-up of oxygen and digested food

excretion: getting rid of waste products

AIM | What are respiration and excretion? 4

RESPIRATION

All living things need energy to live. Where does this energy come from?

Animals get energy by linking the oxygen they breathe with the food that they eat. This important life function is called respiration.

Here is what happens:



The same thing happens in a plant. Oxygen enters a plant through the stomates (tiny holes in the leaves). The oxygen then links up with the food in the plant to produce energy.

EXCRETION

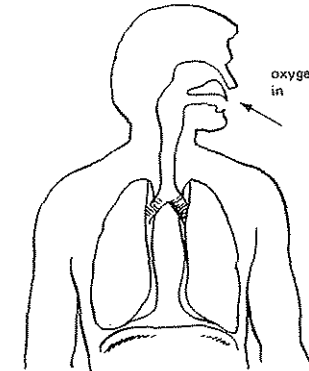
Excretion is the removal of waste products. The body makes several kinds of waste products. For example, the body cannot digest some kinds of foods. These undigested foods make up *solid waste*. Respiration also produces waste products. Water, carbon dioxide, and heat are all waste products of respiration.

The body must excrete waste products. In many animals, carbon dioxide leaves the body through the lungs. Solid wastes are excreted by the large intestine. The liquid waste, urine, is made in the kidneys. Urine is made up of water, heat, and harmful chemicals. Heat and water, as well as salt, are excreted by the body through the skin as *perspiration* [pur spuh RAY shun].

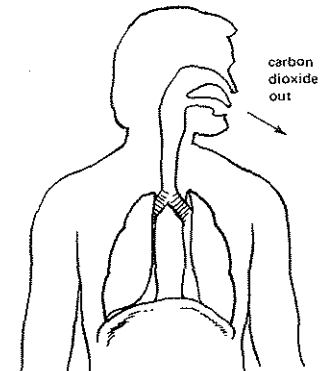
Plants also excrete the waste products of food-making and respiration. Plants excrete oxygen, carbon dioxide, water, and heat through their stomates.

ABOUT BREATHING AND RESPIRATION

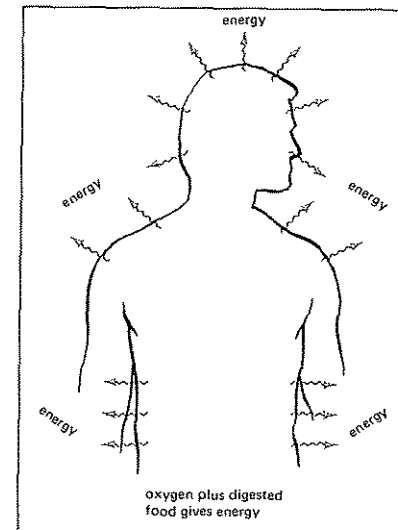
Breathing and respiration are related—but they are not the same. Breathing is necessary for respiration to take place. *Breathing* is the process of taking oxygen into the body and sending carbon dioxide out of the body.



Breathing in (inhaling) sends oxygen into the lungs.



Breathing out (exhaling) sends carbon dioxide waste out of the lungs.



Respiration takes place in every part of the body. Respiration uses the oxygen that inhaling brings into the body.

Try to answer these questions about respiration.

1. What brings the oxygen to all parts of the body? _____
2. What does respiration make that living things need? _____
3. What waste materials does respiration give off? _____

ABOUT EXCRETION

Waste materials leave the body through many paths. Look at the picture. Certain parts of the body are labeled. Each part gets rid of certain wastes.

The waste products are

carbon dioxide	harmful chemicals
solid waste	water
salt	heat

- Write the correct waste product next to the part. Remember, some waste leaves the body through more than one part.

Skin _____

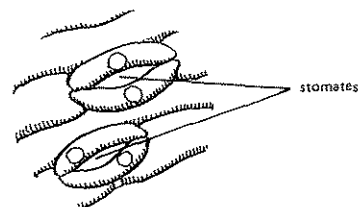
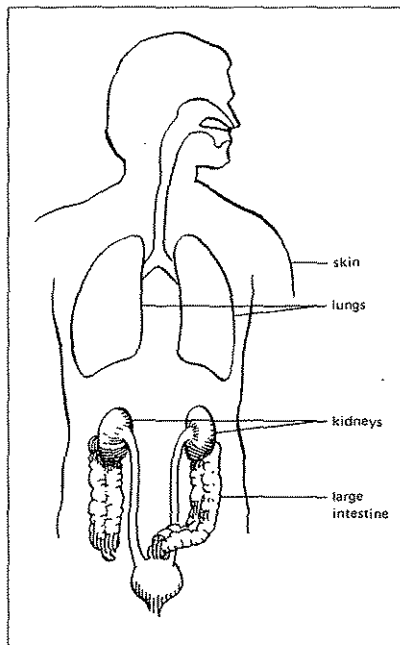
Large intestine _____

Lungs _____

Kidneys _____

Stomates are tiny holes on the underside of a plant's leaves. Oxygen from the air enters a plant through the stomates. Waste products are excreted by a plant through the stomates.

- What waste materials leave a plant through the stomates? _____



COMPLETING SENTENCES Complete the sentences with the words below.

kidneys
excretion
lungs

life functions
heat
water
carbon dioxide

oxygen
stomates
large intestine
respiration

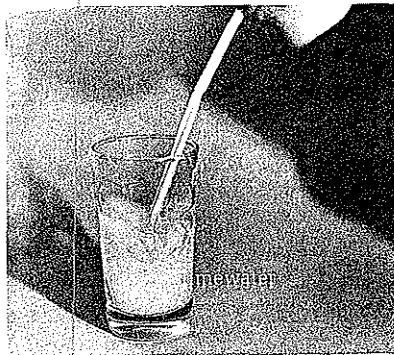
- Energy lets us carry out the _____.
- Energy is given off when _____ links up with digested food.
- When energy is given off, _____ and _____ are also given off as waste.
- The link-up of oxygen with digested food to give energy, carbon dioxide, and water is called _____.
- Getting rid of waste materials in living things is called _____.
- Oxygen waste leaves plants through tiny holes called _____.
- In many animals, carbon dioxide waste is excreted through the _____.
- Solid animal waste leaves through the _____.
- Most liquid wastes are excreted through the _____.
- Two waste products that the skin helps excrete are water and _____.

MATCHING Match the two lists. Write the correct letter on the line next to each number.

- | | |
|-------------------------|--|
| 1. _____ respiration | a) gets rid of wastes |
| 2. _____ excretion | b) tiny holes in leaves |
| 3. _____ kidneys | c) all the activities of living things |
| 4. _____ stomates | d) produces energy |
| 5. _____ life functions | e) make urine |

REACHING OUT Why do earthworms come up from the ground when it rains very heavily?

HOW CAN WE SHOW THAT WE EXHALE CARBON DIOXIDE?



What you need
 limewater drinking straw
 drinking glass

What you need to know
 1. Limewater is a clear liquid.
 2. Limewater turns milky when it is mixed with carbon dioxide.

How to do the experiment
 1. Pour some limewater into the glass.
 2. Blow into the limewater through the straw.

What you saw
 What you learned

1. The limewater stayed clear, turned milky.
2. The gases that mixed in with the limewater came from the air, lungs.
3. This shows that the lungs excrete carbon dioxide, oxygen.

WHAT ARE LOCOMOTION AND RESPONSE TO STIMULI?



5





stimulus: anything that causes change or activity in an organism

locomotion: movement of an entire organism from place to place without outside help

AIM | What are locomotion and 5 | response to stimuli?

LOCOMOTION

All living things can move by themselves. Many animals, including people, move around a great deal. Movement of an entire organism from place to place without outside help is called *locomotion*.

RESPONSE TO STIMULI

When you have an itch, you react by scratching. When the sun rises, the petals of a flower open. These are examples of responses to stimuli (singular stimulus).

Anything that causes change or activity in an organism is a stimulus. The change or activity caused by a stimulus is a response. A stimulus is like a message. A response is like an answer to the message.

All living things respond to stimuli. These responses help organisms stay alive.

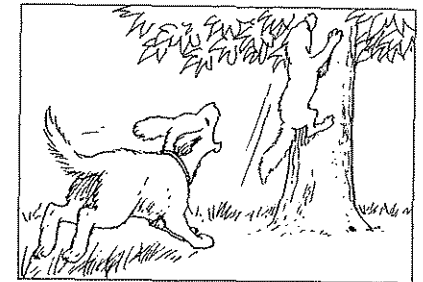
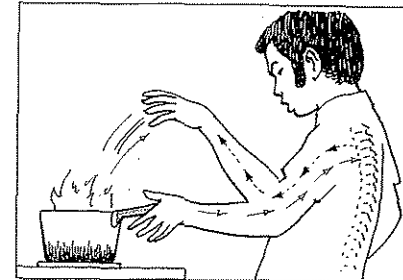
If you put your hand on a hot stove and leave it there, you will be badly burned. Usually, if you touch a hot object, you quickly pull your hand away. You don't even have to think about it. This type of response is *inborn*. An inborn response is a knowledge or ability an organism is born with.

Not all responses are inborn. Many responses are *learned*. For example, you can teach a dog to sit up when you say "Sit!" Babies can learn to say "Mama" when they want their mothers.

Plants cannot learn from experience. All plant responses are inborn. For example, the roots of a plant grow toward water. Plant stems and leaves turn toward sunlight. Clearly, plants would die if they did not respond to stimuli.

WHAT DO THE PICTURES SHOW? Read about each picture. Then answer the questions with each picture.

Animals have nerves and muscles. A stimulus is a message to the nerves. The nerves tell the muscles to react. The muscles react by moving in certain ways.



1. What is the stimulus for the man?

2. What message did the nerves receive? _____
3. What did the nerves tell the muscles to do? _____
4. What is the stimulus for the cat?

5. What message did the nerves receive? _____
6. What did the nerves tell the muscles to do? _____



These three pictures show how the pupils of our eyes react to light. Light is a stimulus. The top picture shows how our pupil might look in a dark room. The bottom picture shows how our pupil might look in bright light. The middle picture shows the eye in normal light.

1. In bright light, what happens to the size of our pupils?

2. In dim light, what happens to the pupil size? _____
3. How does this reaction by the pupil help a person? _____

TRY THIS EXPERIMENT

Get a flashlight and stand in front of a mirror.

Hold the flashlight next to your cheek. Tilt it upward so you can see into your eyes.

Now, look at your eyes in the mirror.



Turn the flashlight on. What happens to your pupils? _____

Turn the flashlight off and look in the mirror. What happens to your pupils? _____

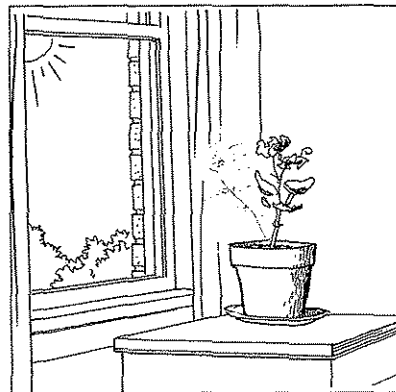
PLANT RESPONSES TO STIMULI

Plants, like animals, respond to stimuli. The responses of plants to certain outside stimuli are called tropisms [TROH piz umz]. Four common stimuli that cause tropisms in plants are light, gravity, water, and touch.

The petals of a flower open in the morning when the sun rises. When the sun sets, the petals of the flower close again. The petals react to the light that comes from the sun.

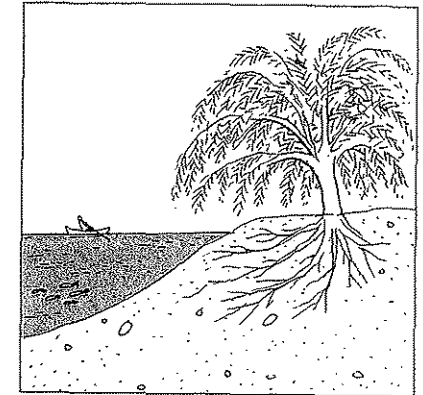
The response of a plant to light is called phototropism. Photo- means light.

Another common phototropism is the movement of the stem and leaves of a plant toward the sun.



The roots of a plant respond to two different stimuli. The roots grow downward because of the pull of gravity. This downward growth of a plant's roots is called geotropism. Geo- means earth.

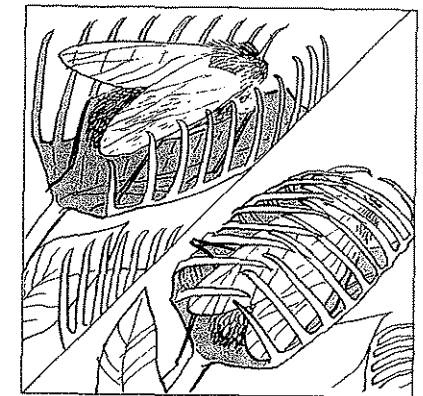
A plant's roots also grow toward water. The growth of a plant's roots toward water is called hydrotropism. Hydro- means water.



Some plants respond when they are touched. The response of a plant to touch is called thigmotropism. Thigmo- means touch.

The mimosa plant closes up its leaves when they are touched. Venus's flytrap has the same reaction.

When an insect touches the leaves of Venus's flytrap, the leaves of the plant snap shut around the insect. The insect is then trapped in the plant's leaves.

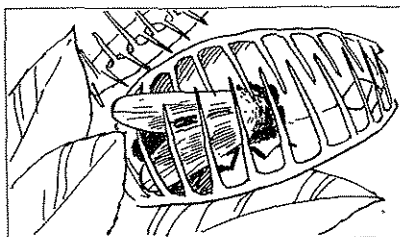


STIMULI AND RESPONSES

Look at each of the pictures.

1. What is the stimulus in each picture?
2. What is the response in each picture?

- a) 1. stimulus _____
2. response _____



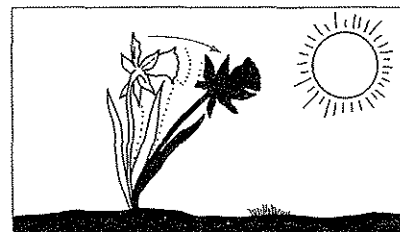
- b) 1. stimulus _____
2. response _____



- c) 1. stimulus _____
2. response _____



- d) 1. stimulus _____
2. response _____



COMPLETING SENTENCES

Complete the sentences with the words below. Two answers will be used twice.

water
tropisms
stimulus
animals

inborn
outside
plants

response
light
inside

1. A _____ is like a message.
2. A _____ is like an answer to the message.
3. Stimuli can come from _____ or _____ of a living thing.
4. Pain is an example of a _____.
5. Saying "Ouch!" is an example of a _____.
6. Responses that do not have to be learned are said to be _____.
7. All responses by _____ are inborn responses. Responses to stimuli by _____ can be inborn or learned.
8. The responses of plants toward certain stimuli are called _____.
9. The stimulus that makes a plant's petals open and close is _____.
10. The roots of a plant grow downward and toward _____.

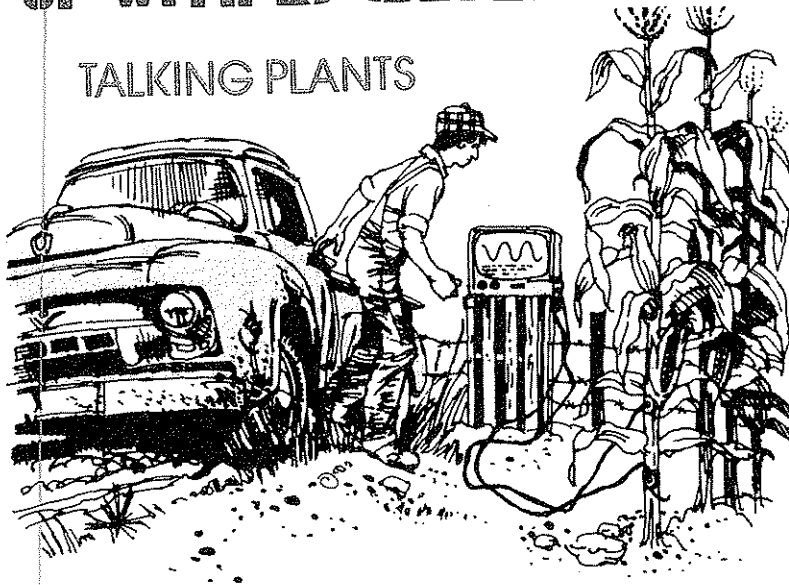
TRUE OR FALSE

Write T on the line next to the number if the sentence is true.
Write F if the sentence is false.

1. _____ A stimulus is like an answer to a message.
2. _____ A response is like an answer to a message.
3. _____ The plural for stimulus is stimuluses.
4. _____ Only living things respond to stimuli.
5. _____ Stimuli can come only from outside an organism.
6. _____ A response can take place inside an organism.
7. _____ A stimulus brings on a response.
8. _____ A tropism is a kind of plant stimulus.

KEEPING UP WITH SCIENCE

TALKING PLANTS



You may have heard of people talking to plants. People may talk, but scientists do not believe that plants can "listen." Now let's turn this idea around. Can plants "talk?"

At least one informed researcher believes they can. Not in word language of course, but "talking" by means of electrical signals.

William Gensler is an electrical engineer at the University of Arizona. Several years ago, he began an investigation to find out if plants send out some kind of signals under various situations.

All living things produce very weak electrical currents. Gensler put electrodes into several kinds of plants. He was hoping to detect changes in electrical output during different periods of time.

The electrical output from the plants were recorded every 15 minutes. Outside conditions like temperature and moisture were also recorded.

As yet, the results are not clear. Gensler reports that cotton plants seem to show an electrical response to watering. Other signals may indicate the best time for adding fertilizer and for harvesting.

Gensler's work is in its early stages. But it has great potential. He has received financial grants from the U.S. Department of Interior and from local farmers.

Gensler sees the day when a farmer will consult an electron screen. The screen will advise him what to do with his crops—and when to do it.

If plants can "talk" people should be most willing to listen.

WHAT ARE GROWTH AND REPRODUCTION?

				6			
			growth: getting bigger and older reproduction: creating new life; making more of one's own kind sexual reproduction: reproduction that requires two parents—one male and one female asexual reproduction: reproduction that requires only one parent sperm cells: cells made by the male for reproduction egg cells: cells made by the female for reproduction				

AIM | What are growth and reproduction?

6

GROWTH

You can make a snowball "grow" into a snowman. But the snowball doesn't really grow by itself. It gets bigger because you add more snow to it.

You have grown a lot since you were born. Growth is a life function. Only living things can grow by themselves. Non-living things cannot grow by themselves.

REPRODUCTION

Mature (fully developed) organisms can reproduce. When organisms reproduce, they make more of their own kind. Organisms can reproduce only their own kind. For example, mice can give birth only to mice. They cannot give birth to kittens or people. Elm trees reproduce only elm trees. Roses reproduce only roses.

Most animals (including people, kittens, and mice) create new life through the process of sexual reproduction. Sexual reproduction requires two parents—one male and one female.

In sexual reproduction, male organisms produce male sex cells. Female organisms produce female sex cells. Reproduction occurs when the male sex cells and female sex cells unite.

Many plants reproduce through sexual reproduction also. You may be surprised to learn that there are male and female plants. During reproduction, male sex cells unite with female sex cells to form seeds. A new plant may grow from each seed.

Many organisms reproduce without sex cells. This kind of reproduction is called asexual reproduction. Asexual reproduction requires only one parent.

Bacteria reproduce through asexual reproduction. A bacterium grows to full size. Then it divides in half. Two new bacteria are created.

Some plants also reproduce asexually. For example, strawberry plants grow runners. The runners root in the ground. A new plant then grows from the runner.

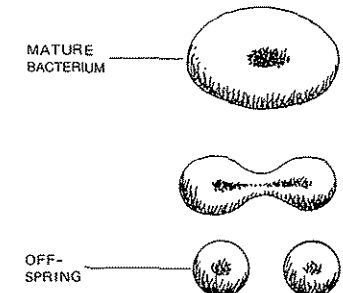
WHAT DO THE PICTURES SHOW?

Read about each picture. Then answer the questions next to the picture.

Bacteria (sing. bacterium) are microscopic organisms. Bacteria reproduce only after they have grown to full size.

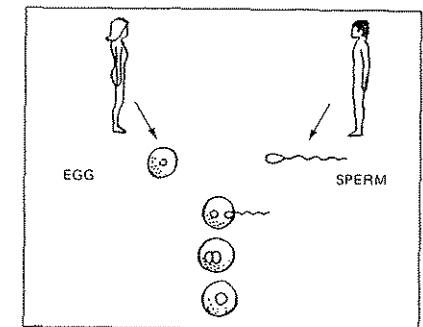
This illustration shows a bacterium reproducing.

1. How do bacteria reproduce? _____
2. What will happen to the new bacteria? _____



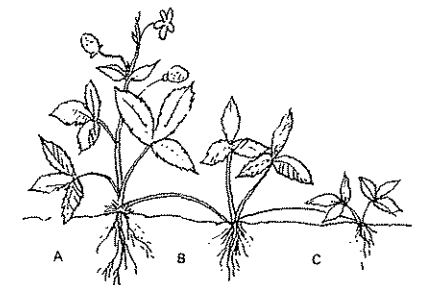
In most animals, male and female sex cells are needed for reproduction. Only mature animals produce sex cells. Mature male animals produce sperm. Mature female animals produce eggs. Reproduction occurs when a sperm cell unites with an egg cell.

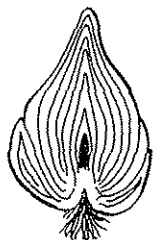
3. Can reproduction take place if the male or female does not mature? _____



This shows a strawberry plant giving off runners.

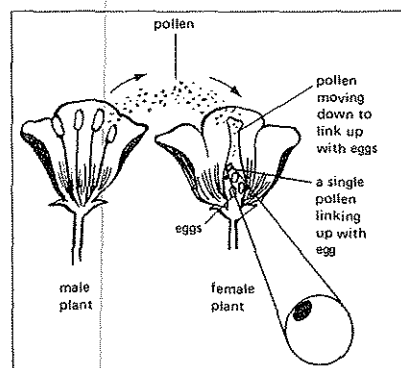
4. How many runners are shown? _____
5. How many plants are shown? _____
6. Which plant is the oldest? _____





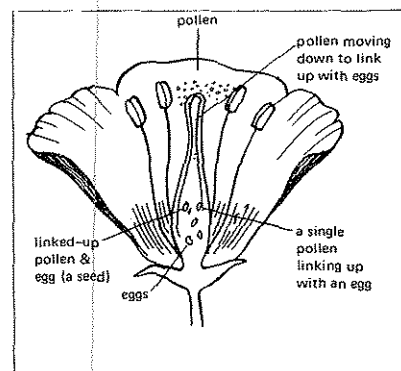
This is the inside of a lily bulb. If a bulb is planted entirely beneath the ground, it produces a new plant. Some bulbs can be recognized by the layering.

7. Name a common bulb that you will probably find in your kitchen. _____



There are male and female plants. Male plants give off special cells called pollen. The pollen comes together with egg cells in the female plant. This produces seeds.

8. What will happen if the seeds are planted in the ground? _____



Some plants are both male and female. They make pollen cells and egg cells.

9. Why might this kind of reproduction be easier than having a male plant and a female plant? _____

A SPECIAL KIND OF GROWTH AND REPRODUCTION

Many organisms are capable of a special kind of growth and reproduction. This kind of growth and reproduction involves the growing back of lost or damaged body parts. This process is called regeneration [ree jen uh RAY shun].

Much of the healing that takes place in our bodies involves regeneration. For example, if you cut your finger, new skin is produced by your body. The new skin grows over the cut. If you break a bone, new bone grows.

Can you think of other examples of regeneration? _____



COMPLETING SENTENCES

Complete the sentences with the words below. One word may be used twice.

changes
matures
male and female

grow
reproduction
dividing in half

parent
seeds
other life

- From the moment of birth, living things _____ in size.
- An organism that grows also _____.
- A mature organism can become a _____.
- Maturity happens when certain _____ take place in an organism.
- Producing new life is called _____.
- All life comes from _____.
- Asexual reproduction requires only one _____.
- Bacteria reproduce by _____.
- In most animals, reproduction needs a _____.
- Some plants reproduce from _____.

TRUE OR FALSE Write T on the line next to the number if the sentence is true.
Write F if the sentence is false.

1. _____ Without reproduction, life could not continue.
2. _____ Only mature organisms can reproduce.
3. _____ All mature organisms are big.
4. _____ All plants reproduce by seeds.
5. _____ A monkey can give birth to a cat.
6. _____ Bacteria reproduce by runners.
7. _____ There are male and female plants.
8. _____ A rock can form life.
9. _____ Everything that gets bigger is alive.
10. _____ People grow in size all their lives.

WORD SCRAMBLE Look at the list of words. Unscramble each to form a word or term that you have read in this aim.

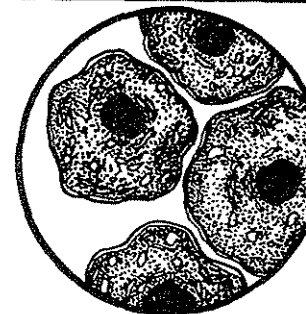
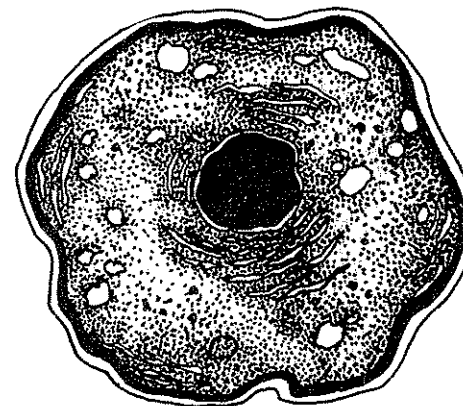
1. GHINALE _____
2. THROWG _____
3. MEAL _____
4. BREATACI _____
5. TOONIPERCRUD _____

REACHING OUT There are three kinds of maturity. There is *physical* maturity, *sexual* maturity, and *emotional* maturity.

1. Which kind of maturity is needed for reproduction to be possible? _____
2. What is meant by the other two kinds of maturity? (You may use a dictionary.) _____

WHAT IS A CELL?

7



cell: the basic unit of structure in living things

cell membrane: the thin outer covering of a cell

nucleus: the part of a cell that controls the cell

nuclear membrane: the thin outer covering of the nucleus

cytoplasm: the jelly-like substance inside a cell between the nucleus and the cell membrane

protoplasm: the living material of a cell

AIM | What is a cell?

7

The invention of the microscope made many important discoveries possible. One of these discoveries was made by the English scientist Robert Hooke in 1665. Hooke discovered that all living things are made up of even smaller living parts. He called these living parts *cells*.

All living things are made up of cells. Some organisms, like large plants and animals, are made up of billions of cells. Others, like bacteria, are made up of only one cell.

Cells are living things. All of the life functions are carried out by every cell.

The cell itself is made up of smaller parts. These parts include the *cell membrane* [MEM brane], the *nucleus* [NEW klee us], the *nuclear* [NEW klee ar] membrane, and the *cytoplasm* [SY toh plaz um]. All of these parts are made up of a living substance called *protoplasm* [PRO tuh plaz um].

Plant and animal cells are not exactly alike. Plant cells have some parts that animal cells do not have. These parts are the *cell wall* and the *chloroplasts* [KLOR uh plasts].

CELL MEMBRANE The cell membrane is like a thin skin that covers the cell. It protects the cell and gives it its shape. The cell membrane has tiny holes in it. Materials enter and leave the cell through these tiny holes.

NUCLEUS The nucleus is inside the cell. It controls everything that happens in the cell. The nucleus is like the "boss" of the cell. The nucleus is usually near the center of a cell.

NUCLEAR MEMBRANE The nuclear membrane surrounds the nucleus. It controls the passage of materials into and out of the nucleus.

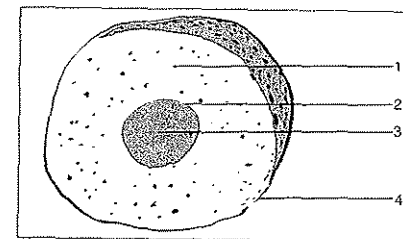
CYTOPLASM The cytoplasm is a jelly-like substance located between the nucleus and the cell membrane. It fills most of the inside of the cell. Like the cell membrane, the cytoplasm helps give a cell its shape. Most of the life functions take place in the cytoplasm.

FIND THE PARTS

The illustration on the right shows an animal cell. Four parts of this animal cell are shown. They are: the nucleus, the cell membrane, the nuclear membrane, and the cytoplasm.

Find each part of the cell in the picture. Write the name of each part on the correct line.

Are these parts also found in plant cells? _____

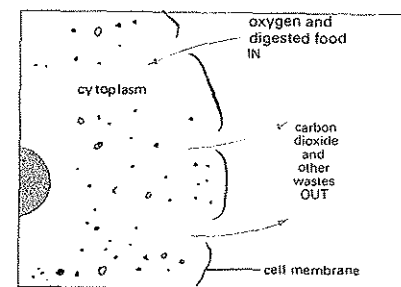


PARTS OF AN ANIMAL CELL

WHAT DO THE PICTURES SHOW?

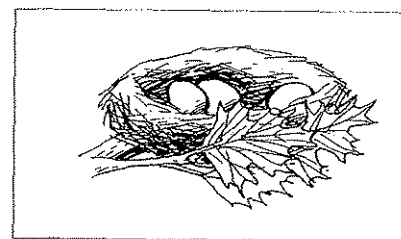
The cell membrane has tiny holes in it. Materials needed for the life functions enter the cell through these holes; waste materials leave.

1. What needed materials enter the cell through the cell membrane? _____
2. What waste materials leave the cell through the cell membrane? _____



A bird's egg is made up of only one cell. A bird's egg has a hard shell that covers the cell membrane.

3. Do you need a microscope to see this cell? _____
4. What extra part does a bird's egg have that most other cells do not have? _____



A SPECIAL KIND OF CELL

HOW ARE PLANT CELLS DIFFERENT FROM ANIMAL CELLS?

Plant cells and animal cells are not exactly alike. Plant cells have certain parts that animal cells do not have. These parts include a cell wall and chloroplasts.

■ The cell wall is located outside the cell membrane of a plant cell. It surrounds the entire plant cell.

The cell wall is made of a nonliving material called *cellulose* [SELL yuh loas]. The cell wall is more rigid (stiff) than the cell membrane. It gives a plant cell its stiffness. It also gives it its shape.

■ Chloroplasts are found in the cytoplasm of a plant cell. Chloroplasts contain a green substance called chlorophyll [KLOR uh fill].

Chlorophyll is needed by green plants for food-making. The food-making process of green plants is called *photosynthesis* [fo tuh SIN thuh sis]. Most chlorophyll is found in the leaf cells of green plants.

Plants can make their own food. Animals cannot. Animal cells do not contain chlorophyll.

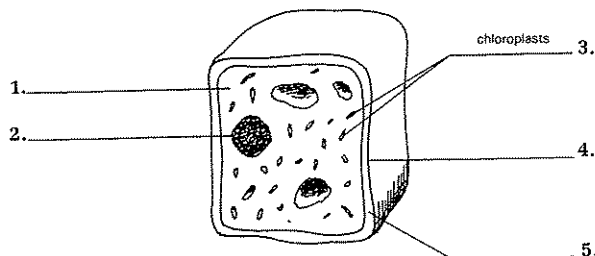
1. Does photosynthesis take place in animals? _____

2. Why? _____

MORE ABOUT PLANT CELLS

The picture on the right shows a plant cell. The parts of the plant cell that are shown in the picture are listed below.

cell membrane
nucleus
chloroplasts
cytoplasm
cell wall



I. Find each part of the plant cell in the picture. Write the name of the part on the correct line in the picture. One of the parts has been labeled for you.

Now, answer the questions about plant cells.

1. What is found inside of the chloroplasts? _____

2. What is this material used for? _____

II. Answer the following questions about plant and animal cells.

1. What two parts do plant cells have that animal cells do not have?

_____ and _____

2. What is the cell wall made of? _____
protoplasm, cellulose

3. Is cellulose living material? _____
yes, no

4. What is the cell membrane made of? _____
protoplasm, cellulose

5. Is protoplasm living material? _____
yes, no

6. Where are the chloroplasts located? _____
in the nucleus, in the cytoplasm

7. What substance is found inside the chloroplasts? _____
protoplasm, chlorophyll

8. What is the substance inside the chloroplasts used for? _____
food-making, excretion

9. Can animals make their own food? _____
yes, no

10. Why can't animals make their own food? _____

MATCHING Match the two lists. Write the correct letter on the line next to each number.

1. _____ chloroplasts and cell wall

2. _____ protoplasm

3. _____ photosynthesis

4. _____ nucleus, nuclear membrane, cell membrane, cytoplasm

5. _____ cellulose

a) parts of all cells

b) food-making process of plants

c) found only in plant cells

d) nonliving material of the cell wall

e) any living material of the cell

COMPLETING SENTENCES

Complete the sentences with the words below. Three words will be used twice.

chlorophyll	cell membrane	life functions
living	cellulose	cell wall
chloroplasts	cytoplasm	nuclear membrane
nucleus	waste products	

- The parts that all plant and animal cells have are the _____, the _____, the _____, and the _____.
- A plant cell has two parts that animal cells do not have. They are the _____ and the _____.
- Cells are _____ things. All of the _____ are carried out in every cell.
- The _____ is the control center of the cell.
- Materials needed for the life functions enter the cell through the _____.
- _____ leave the cell through the cell membrane.
- The cell wall of a plant cell is made of a nonliving substance called _____.
- The special cell parts needed for food-making in plants are the _____.
- Chloroplasts contain a green substance called _____.

WORD SCRAMBLE

Unscramble each of the following to form a word or term that you have read in this aim. Write your word in the spaces below.

- PALCOTMYS _____
- SUNECUL _____
- RAMBENME _____
- SAMPLOTROP _____

WHAT DO THE PICTURES SHOW?

Look at each picture. Answer the questions next to each picture.

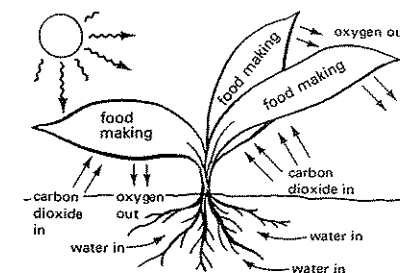
- What holds up a person? _____



- What holds up a plant? _____



- What is taking place in this picture? _____



- In what part of a plant is food made? _____

TRUE OR FALSE Write T on the line next to the number if the sentence is true. Write F if the sentence is false.

- _____ A rock has cells.
- _____ Most of a cell is the nucleus.
- _____ Only the nucleus of a cell is protoplasm.
- _____ The cell membrane has holes.
- _____ Most cells are microscopic in size.
- _____ Plant cells and animal cells are exactly alike.

REACHING OUT

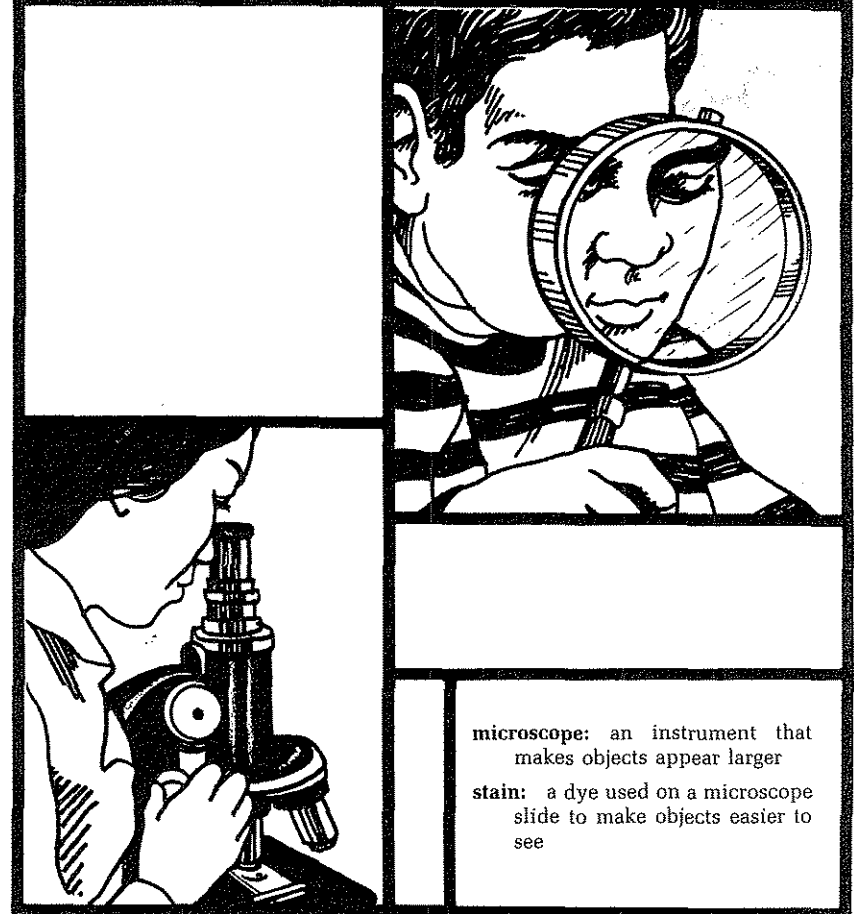
1. Without looking back, try to draw a picture of an animal cell. Label the nucleus, the nuclear membrane, the cell membrane, and the cytoplasm.

2. Now try to draw a picture of a plant cell. Label the nucleus, the nuclear membrane, the cell membrane, the cell wall, the cytoplasm, and the chloroplasts.

3. What do you think would happen if waste products could not leave a cell? ____

HOW CAN A MICROSCOPE HELP US STUDY LIVING THINGS?

8



microscope: an instrument that makes objects appear larger

stain: a dye used on a microscope slide to make objects easier to see

AIM | How can a microscope help us

8 | study living things?

All living things are made up of cells. Some organisms, like bacteria and protozoa [pro tuh ZO uh], are made of only one cell. They are much too small to be seen with the naked eye alone. These organisms are called **microorganisms** [MY kro OR guh niz imz].

How can we see and study such tiny organisms? We can see these organisms with the help of a microscope. A microscope is an instrument that makes objects appear larger. Have you ever used a magnifying lens? A magnifying lens is a simple microscope. A simple microscope has only one lens.

A magnifying lens, or hand lens, is easy to use. It is small, and it doesn't weigh much. But a hand lens doesn't magnify objects very much. We cannot see one-celled organisms with a hand lens.

A compound microscope is much more powerful than a simple microscope. A compound microscope has two sets of lenses. Most school microscopes are compound microscopes.

Most compound microscopes can make objects appear 100 to 400 times larger than they really are. Some, can magnify objects as much as 1,000 times. When we talk about a "microscope", we usually mean a compound microscope.

Another type of microscope is the **electron microscope**. Electron microscopes are used to study the smallest living things, such as viruses. You will learn more about viruses in another Aim. Electron microscopes can magnify objects up to 100,000 times. These microscopes are found in scientific laboratories.

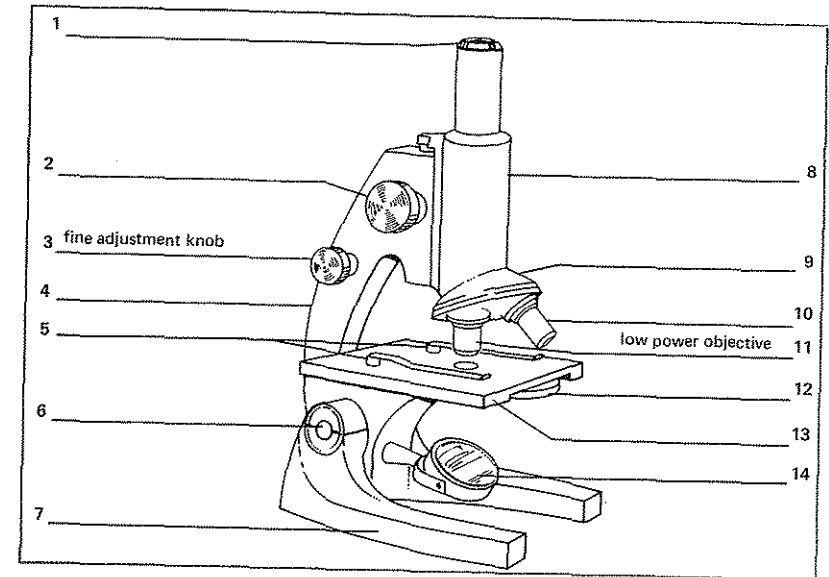
Microscopes have many uses, especially in biology, the study of living things. Doctors often use microscopes. Have you ever seen a microscope in your doctor's office?

WHAT ARE THE PARTS OF A MICROSCOPE?

This is a picture of a compound microscope. A compound microscope has more than one lens.

The important parts of the microscope are listed below the picture.

1. Read the description of each part.
2. Then find the part in the picture.
3. Write the name of the part on the correct line. Some of these have been done for you.



PARTS OF THE MICROSCOPE

Eyepiece Lens closest to the eye.

High Power Objective Longer of the two lenses close to the slide.

Low Power Objective Shorter of the two lenses close to the slide.

Tube Gives the distance needed between the eyepiece and objective.

Coarse Adjustment Knob Moves the tube up and down.

Fine Adjustment Knob Also moves the tube up and down but only slightly.

Base Holds up the entire microscope.

Arm Holds the tube and lenses. Connects to the base.

Nosepiece Holds objective lenses.

Mirror Reflects light into the tube.

Diaphragm Circular disk that lets more or less light pass through.

Stage Platform for slide to rest. An opening in its center lets light pass through.

Clips (2) Hold the slide in place on the stage.

Tilting Joint Lets you tilt the microscope to a comfortable position.

HOW DOES A MICROSCOPE MAGNIFY?

A microscope makes things look bigger. It does this because light coming from the object passes through lenses. These lenses magnify the object.

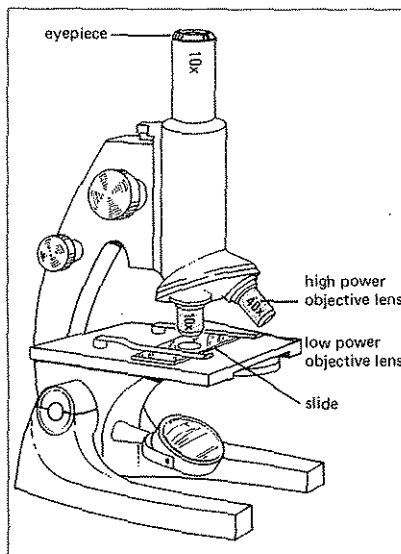
This picture shows three lenses of a compound microscope. The top lens is called the *eyepiece*. It is the lens closest to the eye. The other two lenses are called *objectives*. The objectives are the lenses closest to the object being viewed.

The object being viewed is on a *microscope slide*. The slide is placed below the objectives on the microscope stage.

Different lenses magnify to different powers. The power of magnification is marked by a number with an $\times$ next to it. A lens that magnifies ten times is marked $10\times$.

In this picture, the eyepiece is marked $10\times$ and the objective $10\times$. This gives a total magnification of $100\times$. To find the total magnification of a microscope, just multiply the two magnifications.

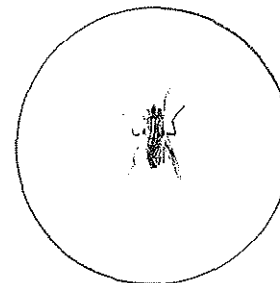
Complete the table below by finding the total magnification for each pair of lenses. For example, the second pair has a total magnification of $400\times$ ($10\times 40 = 400$).



	Eyepiece	Objective lens	Magnification
a)	$10\times$	$10\times$	_____
b)	$10\times$	$40\times$	$400\times$
c)	$10\times$	$44\times$	_____
d)	$5\times$	$10\times$	_____
e)	$5\times$	$40\times$	_____
f)	$20\times$	$10\times$	_____
g)	$20\times$	$40\times$	_____

DISCOVERING MICROSCOPE FEATURES

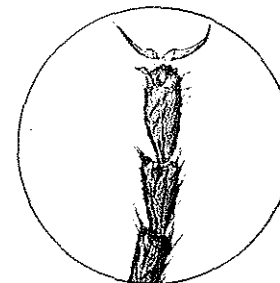
Look at each picture. Then answer the questions next to the pictures.



This is a picture of a common house fly. It has been magnified about two times.

1. Can you see much of the fly's detail?

yes, no



This is what a part of a fly looks like through a microscope. It is magnified 100 times.

2. You now see _____ of the fly, but you see _____ detail.

more, less

more, less

3. What part of the fly do you think this picture shows? _____



This is the same part of the fly. This time it is magnified 400 times.

4. Compared to $100\times$, you now see _____ of the fly. However, you see _____ detail.

more, less

more, less

CONCLUSIONS

1. The higher the magnification of a microscope the _____ of a specimen you see.
2. The higher the magnification of a microscope, the _____ detail you see.

more, less

more, less

MICROSCOPE SLIDES

Objects that are viewed with a microscope are placed on a small piece of glass called a *microscope slide*. A microscope slide is placed on the stage of a microscope below the objectives.

There are two types of microscope slides: *temporary slides* and *permanent slides*.

- A temporary slide cannot be stored. It is used once and then it is cleaned off.

Temporary slides are useful for studying tiny living things while they are still living.

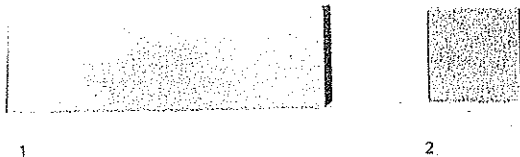
- A permanent slide can be stored and studied over and over again.

Only dead or nonliving things can be studied with a permanent slide.

PARTS OF A MICROSCOPE SLIDE

Most microscope slides have two parts:

- (1) a main glass slide about $7.5\text{ cm} \times 2.5\text{ cm}$ ($3'' \times 1''$) and
- (2) a small and very thin cover glass.



- On a temporary slide, the cover glass just rests on the main glass. It can be taken off easily.
- On a permanent slide, the cover glass is cemented to the main glass. It cannot be taken off.

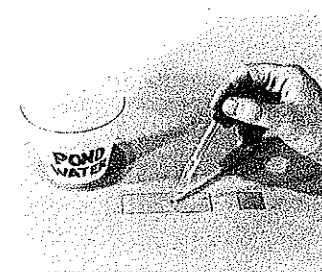
1. What type of slide would you use to study organisms living in pond water while they are still alive? _____
2. Why? _____

MAKING TEMPORARY SLIDES

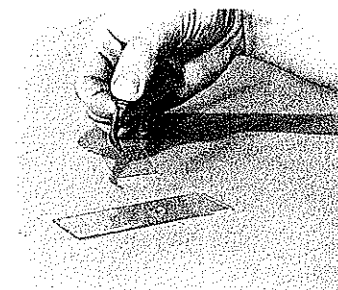
- I. Look at pond water under the microscope by following these directions.

1. Clean the slide thoroughly.

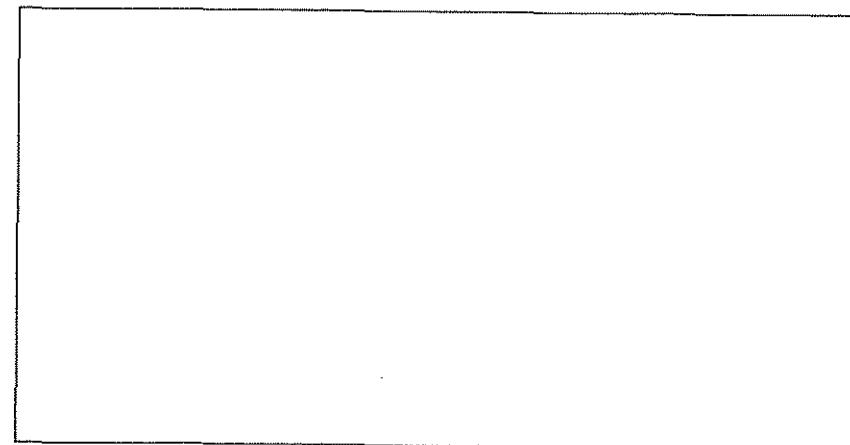
2. Use a clean dropper to place a drop of pond water on the slide.



3. Place a cover glass over the pond water.



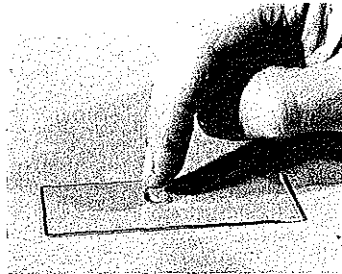
4. Examine your slide under the microscope.
5. Draw a picture of what you see.



- II. Some temporary slides do not need a cover glass.

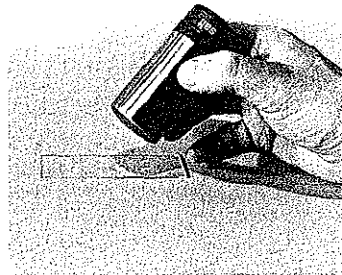
To study salt or a piece of hair under the microscope, follow these directions.

1. Dampen the top surface of the slide very slightly with your finger.



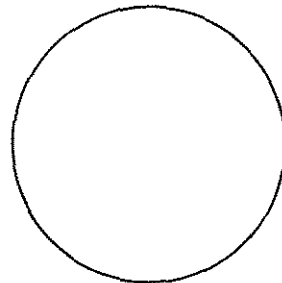
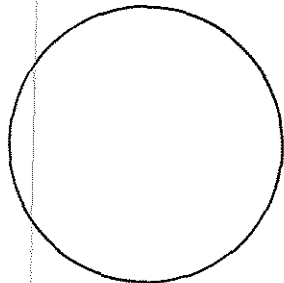
2. Salt—sprinkle a few grains on the glass.

3. Hair—just place it on the slide.



4. Now look at the specimens with the microscope.

5. Draw pictures of what you see.



WHY DO SCIENTISTS USE STAINS?

Some things are *transparent* [TRANS par unt]. You can see right through them. Glass is transparent. So are water and air. A transparent object lets light and detail pass right through it.

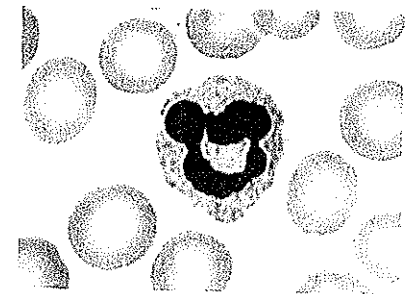
Some cells and cell structures are transparent. This makes these structures hard to see under a microscope. How do scientists study such cells? They use a *stain*.

A stain is a dye. It adds color to the specimen on the slide. This makes the specimen easier to see.

There are many different kinds of stains. Not all cells and cell structures absorb (take in) the same kind of stain. And, different parts of a cell may take in different amounts of stain. This means that some structures may be darker (or lighter) than others. The kind of stain used on a slide depends on what is being studied.

Look at the photo on the right. The photo shows blood cells as they appear under a microscope.

Scientists use a stain to make the white blood cells easier to see. Not all parts of the white blood cell absorb the same amount of stain.

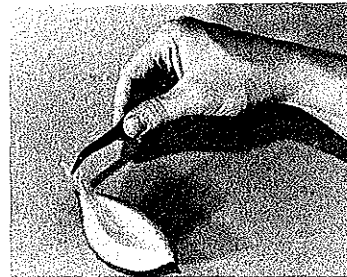


1. What part of the blood cell has absorbed the most stain? _____

2. How do you know? _____

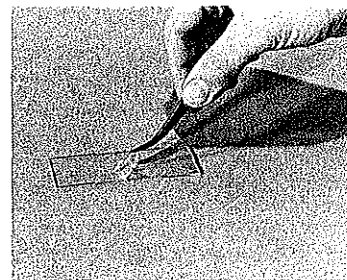
Look at an onion leaf under the microscope by following these directions. First, get the specimen.

1. Separate an onion leaf from a quartered onion. Notice the very thin skin on top.

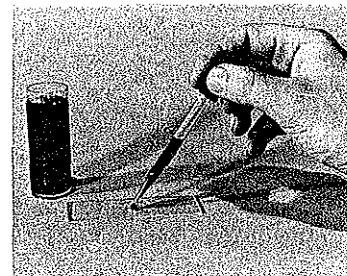


2. Separate this skin.

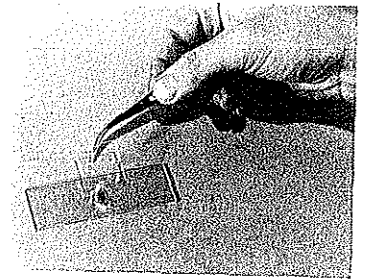
3. Place the thin skin on the slide.



4. Add a drop of iodine to the slide. Iodine is one kind of stain. The stain adds color to the onion skin. This makes the parts of the onion skin stand out more clearly.

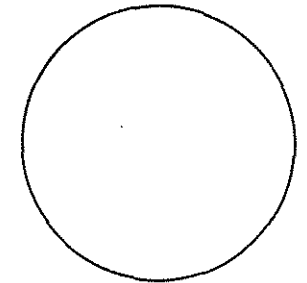


5. Place a cover glass on the slide.



6. Examine your slide under the microscope.

7. Draw a picture of what you see.



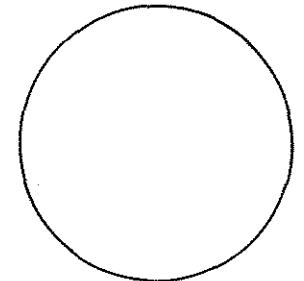
8. Prepare another slide of an onion leaf following directions 1 through 3.

9. Instead of iodine, place a drop of water on the slide.

10. Place a cover glass on the slide.

11. Examine your slide under the microscope.

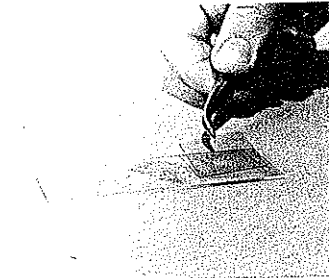
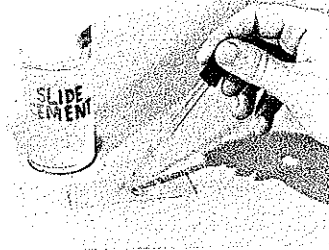
12. Draw a picture of what you see.



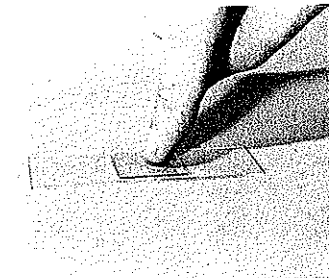
MAKING A PERMANENT SLIDE

Make a permanent slide by following these directions.

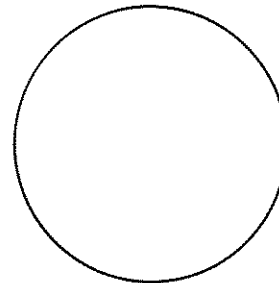
1. Clean and dry the slide and cover glass.
2. Place your "specimen" on the center of slide. (You can use the onion skin or an insect part.)
3. Place one drop of special cement on the specimen.



4. Put on cover glass. (Press down very gently to spread the cement.)



5. Allow the cement to dry.
6. Examine your slide under the microscope.



7. Draw a picture of what you see.

HANDLING A MICROSCOPE

A microscope is a delicate instrument. Treat it carefully. Read about each picture. Then answer the questions next to each picture.

The pupil on the left is not holding the microscope the right way.

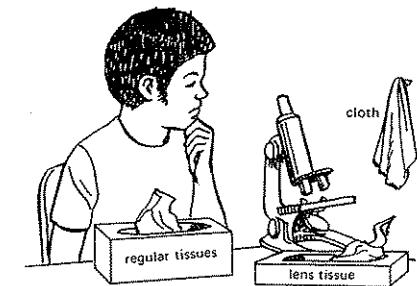
1. Can you describe the right way to hold a microscope?



The boy is wondering what to use to clean the microscope lenses.

2. Which one would you use? _____

3. Why? _____

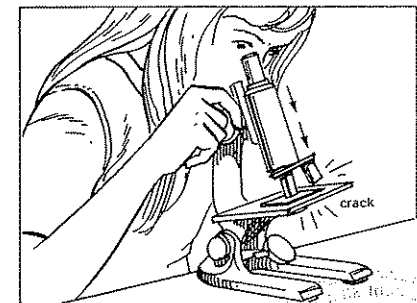


The girl is focusing downward toward the slide.

4. What has happened to the slide?

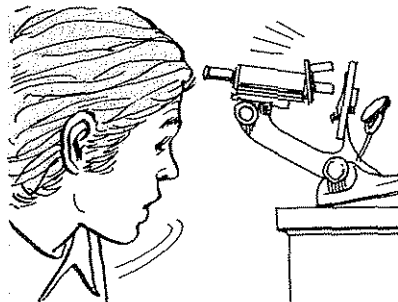
5. Is this the proper way to focus? _____

6. Should you focus upward or downward? _____



7. What is happening to this boy's microscope? _____

8. What should you do to prevent this from happening? _____



TRUE OR FALSE Write T on the line next to the number if the sentence is true.
Write F if the sentence is false.

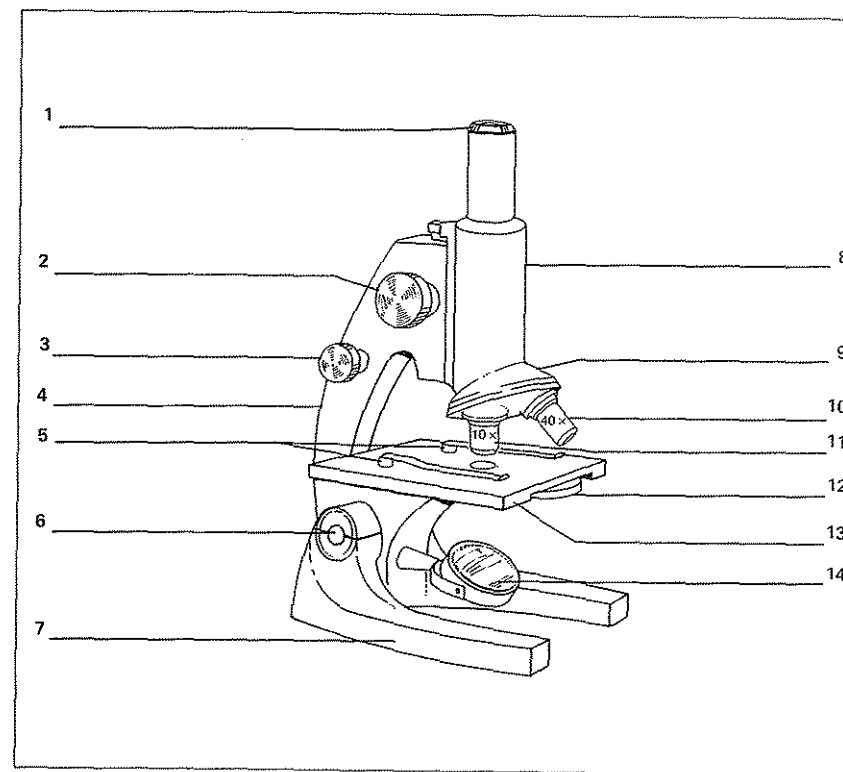
1. _____ A microscope makes things bigger. (Careful, this is tricky!)
2. _____ A microscope can have one lens.
3. _____ Compound microscopes are used on nature walks.
4. _____ A compound microscope magnifies more than a simple microscope does.
5. _____ Light enters the eyepiece first.
6. _____ A microscope stage must have an opening.
7. _____ When you carry a microscope, you should hold it by the tube.
8. _____ Focusing upward can crack a slide.
9. _____ You should use only lens tissue to clean a microscope lens.

MATCHING Match the two lists. Write the correct letter on the line next to each number.

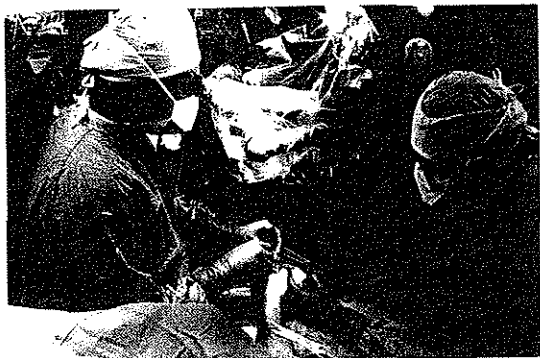
- | | |
|------------------------------|-------------------------------|
| 1. _____ simple microscope | a) supports entire microscope |
| 2. _____ base | b) has only one lens |
| 3. _____ compound microscope | c) study of living things |
| 4. _____ eyepiece | d) has more than one lens |
| 5. _____ biology | e) lens closest to the eye |

FIND THE PARTS Write the name of the microscope part next to the correct line in the picture. The parts are listed below.

Arm	Diaphragm	Low Power Objective
Base	Eyepiece	Mirror
Clips	Fine Adjustment Knob	Nosepiece
Coarse Adjustment Knob	High Power Objective	Stage
	Tilting Joint	Tube



KEEPING UP WITH SCIENCE



MICROSCOPIC SURGERY

One day in June 1979, 17-year-old Renee Katz was standing on a crowded subway platform. She was on her way to school. As the train was pulling into the station, someone pushed Renee onto the tracks. The train came to a screeching halt—but not entirely in time. Part of the train had passed over Renee.

Police and paramedics arrived quickly. It was a miracle that Renee was still alive. But her right hand had been cut off at the wrist. A police officer placed the severed hand in a plastic bag and packed it in ice.

Renee and her separated hand were rushed to a large hospital. The hand was in very poor condition. The skin was almost completely torn away. Some skin and veins were missing; the thumb was crushed.

In spite of this, a team of specially trained surgeons successfully reattached the hand by microsurgery. Blood vessels, tendons, and nerves had to be joined. Lost blood vessels had to be transplanted from

other parts of her body.

Microsurgery is very delicate surgery done on very tiny parts of the body. It is done under a microscope. Very small surgical instruments are used. The tips of the instruments that handle blood vessels and nerves are especially tiny. Without a microscope, you can hardly see them at all.

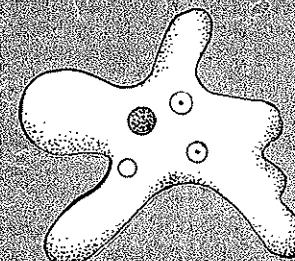
Renee will never have complete use of her reattached hand. But even limited use is better than no hand at all. She now has feeling in the hand, but some numbness still exists. She can grab and hold objects. She can even write with it.

Microsurgery has reattached body parts (including at least one complete scalp). But microsurgery has an even broader use. For example, microsurgery has saved the lives of stroke victims, and has been used to treat eye diseases.

Surgeons are constantly expanding the use of microsurgery. This modern technique will help save people's lives. It will help others to live more useful lives.

HOW ARE LIVING THINGS CLASSIFIED?

9



taxonomy: the branch of biology that deals with the naming and classification of living things

traits: characteristics

AIM | How are living things 9 | classified?

How many different kinds of plants and animals can you name? Twenty? Thirty? . . . Fifty? It may be hard to believe, but we share this planet with millions of different kinds of organisms. So far, nearly 2,000,000 have been identified. And about 6,000 are being added each year. Some scientists believe the number to be more than 10,000,000.

How do we keep track of such large numbers?

Biologists classify living things into groups. Members of the same group are alike in certain important ways. The system of naming living things and classifying them into groups is called *taxonomy* [TAK sahn uh mee].

The first taxonomy system was developed in 1735 by Carolus Linnaeus [KAR ul lus lih NEE us]. This system grouped organisms according to *structure*, or what they looked like. Now we consider other things too—like *cell organization*, *chemical make-up*, and *ancestors*.

THE CLASSIFICATION SYSTEM

The first taxonomy group is the *kingdom*. A kingdom contains the largest number of different life forms. Members of a kingdom share only a few traits or characteristics. In fact, members of the same kingdom may not look alike at all. Take the flea and the elephant, for example. Do they look alike? Of course not! Yet, they do belong to the same kingdom!

Living things may be classified into three kingdoms: the *animal kingdom*, the *plant kingdom*, and the *protist kingdom*.

- The animal kingdom includes all animals.
- The plant kingdom contains all plants.
- Many organisms are difficult to classify. They are not clearly plants or animals. Many scientists place these organisms in the protist kingdom.

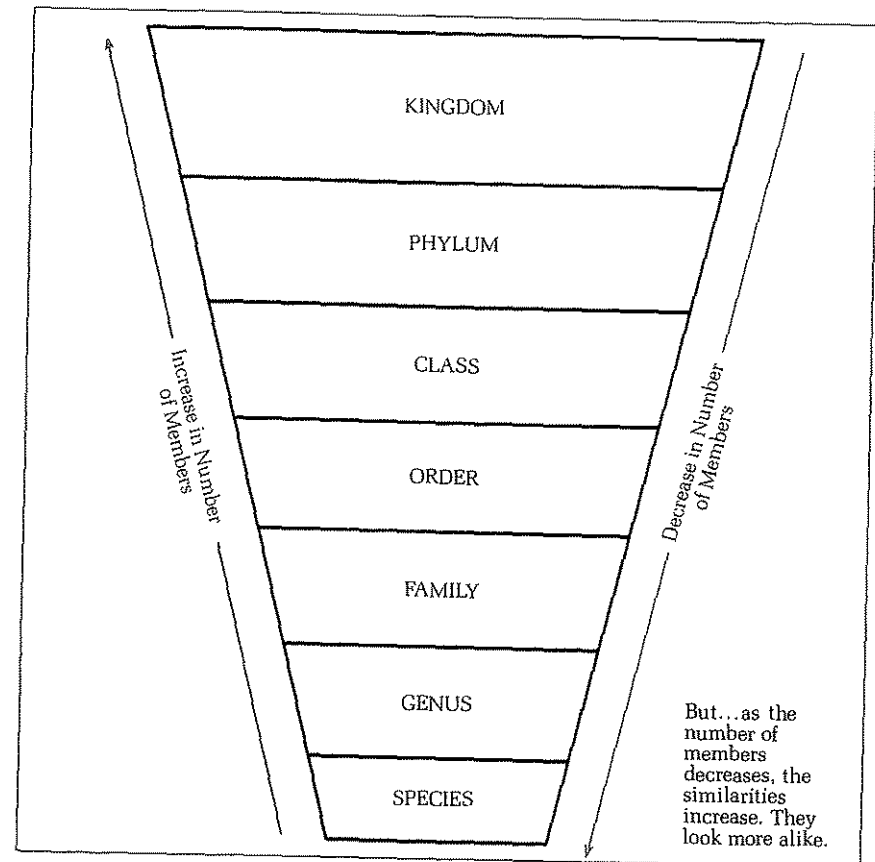
The kingdom is the largest taxonomy group. Each kingdom is then divided into smaller and smaller groups. They are the *phylum* [FY lum], the *class*, the *order*, the *family*, the *genus* [JEE nus], and the *species* [SPEE sheez].

As a group becomes smaller, its members become more similar.

THE CLASSIFICATION SYSTEM

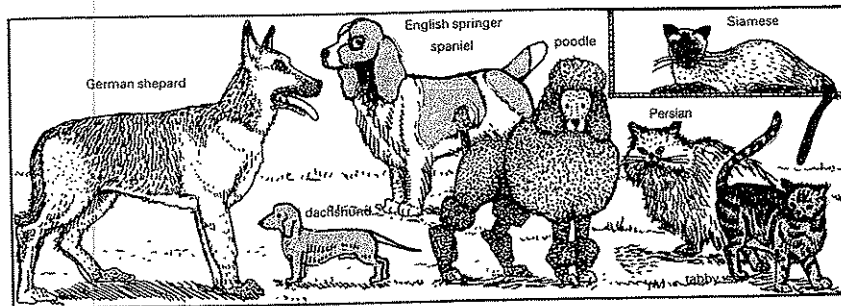
Think of the classification system as an upside-down pyramid. The kingdom is the largest part. It has the most room. So, it can hold the greatest number of organisms—all plants, or all animals, or all protists.

As you move down the pyramid, each room gets smaller. It can hold fewer and fewer members; however, the members have more traits in common. They begin to look more alike.



The *species* is the smallest room in the classification pyramid. It is only large enough for one kind of organism—only humans, or only elm trees, or only robins.

Members of a particular species are very similar . . . Are there any differences? Certainly! But they are mostly individual differences—like the differences between two people, or two elm trees, or two robins.



Some organisms, like dogs and cats, are classified into an even smaller group—the breed. But, regardless of the breed, all dogs belong to one species. All cats belong to another species.

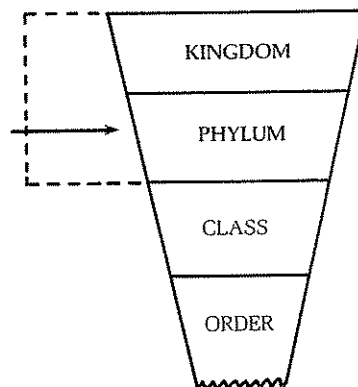
TRACING SIMILARITIES

A member of a particular group has traits that are the same as . . .

- all members of its own group, as well as
- all members of the broader groups in its taxonomy pyramid.

For example: A member of a particular phylum has key traits that are similar to . . .

- all members of that phylum, as well as
- all members of its kingdom.



Now let's answer the questions below. Use this example, and the full taxonomy pyramid on page 69 to help you.

CLASSIFICATION GROUP

SHARES KEY CHARACTERISTICS WITH THESE GROUPS

1. a) a member of a class _____

 b) a member of an order _____

 c) a member of a family _____

 d) a member of a genus _____

 e) a member of a species _____

2. Which are more similar . . .
 a) members of an order or members of a family? _____
 b) members of an order or members of a phylum? _____
 c) members of a genus or members of a family? _____
3. Which group members are most similar? _____
4. Which group members are least similar? _____
5. Which has more members . . .
 a) a phylum or a family? _____
 b) a genus or a family? _____
 c) a class or an order? _____
6. Which group has the most members? _____
7. Which group has fewer members . . .
 a) a family or a genus? _____
 b) an order or a phylum? _____
8. Which group has the fewest members? _____

HUMAN CLASSIFICATION



Dogs belong to the same kingdom, phylum, class, and order as humans. However, dogs do not belong to the same family as humans. Do dogs and humans belong to the same genus?

CLASSIFICATION GROUP

SOME KEY TRAITS

Kingdom: ANIMAL	- cells do not have chloroplasts or chlorophyll; cannot make its own food - cells do not contain cellulose; no cell wall - have some type of nervous system - most can move about from place to place
Phylum: CHORDATE [kor DAYT]	- have a backbone - have an internal skeleton
Class: MAMMALIA [ma MAY lih ah]	- warm-blooded - have fur or hair - produce live young; females produce milk to nurse newborn offspring
Order: PRIMATE [pry MATE]	- generally stand erect (on two feet) - eyes usually in front of head - five digits on each limb - usually have nails instead of claws
Family: HOMINADAE [hoh MIN ih dee]	human-like
Genus: HOMO	- human "qualities", but not yet the human of today - highly-developed brain; can learn through reasoning
Species: SAPIENS [SAYP ee uns]	modern humans

MORE ABOUT CLASSIFICATION

Let's see where other familiar animals belong in this classification.

The animals listed below belong to one or more of the same groups to which humans belong. Which ones are they? (Use the chart on page 72 to help you.)

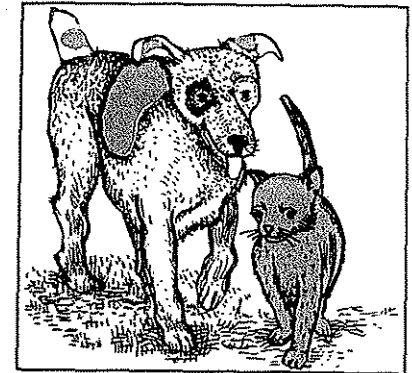
I.

1. Humans belong to certain groups that cats and dogs do. Name these groups from largest to smallest.

_____, _____, _____

2. a) Do dogs and cats belong to the order primate? _____

- b) Why or why not? _____

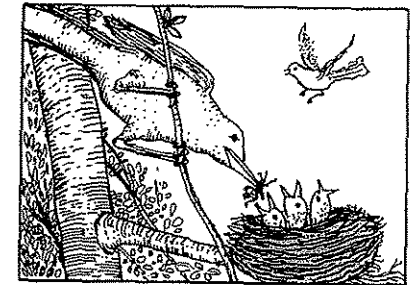


3. If dogs and cats do not belong to the order primate, can they belong to any of the lower groups? _____

II.

1. a) To which "human" groups do birds belong? _____

- b) Why? _____



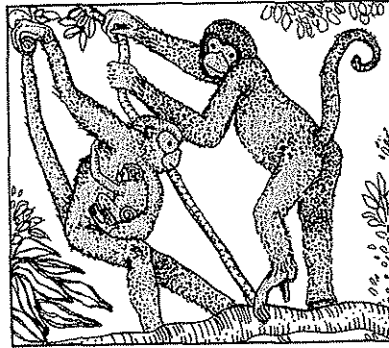
2. a) Do birds belong to the class mammalia? _____

- b) Why or why not? _____

3. Name the groups to which birds do not belong. _____

III.

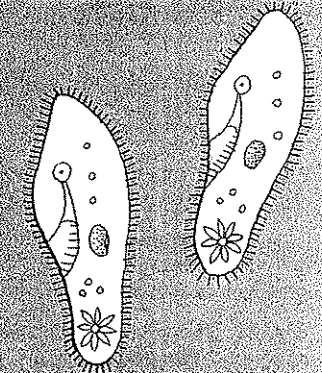
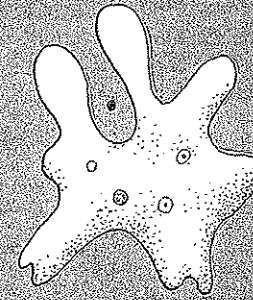
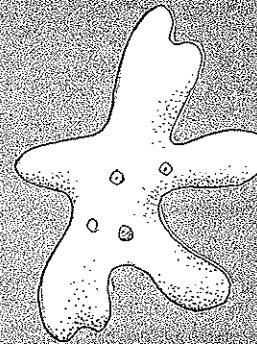
1. Monkeys belong to the class mammalia. Therefore, monkeys must also belong to what other groups? _____



2. a) Do monkeys belong to the order primate? _____
 b) Why or why not? _____
3. a) Do monkeys belong to the genus homo? _____
 b) Why or why not? _____

WHAT ARE PROTISTS?

10



protist: member of a kingdom that includes simple, microscopic organisms that are not clearly plants or animals

AIM | What are protists?

10

Some organisms are not clearly plants or animals. Many scientists group these organisms into a third kingdom—the protist kingdom. Some scientists divide this kingdom into a fourth, or even a fifth kingdom. We will use only three kingdoms. Happy?

In this Aim, you will learn about four kinds of protists. You will learn about bacteria [bak TEER ee uh] and viruses in the next Aim.

PROTOZOANS [pro tuh ZOH unz] are simple animal-like organisms. Most are microscopic and have only one cell.

Protozoans do not have a cell wall. Most protozoans do not make their own food. They don't have chlorophyll. Most protozoans can move about on their own in search of food.

ALGAE [AL gee] are simple plant-like organisms. Most algae have only one cell. They are microscopic. But some algae have many cells and grow to be very large.

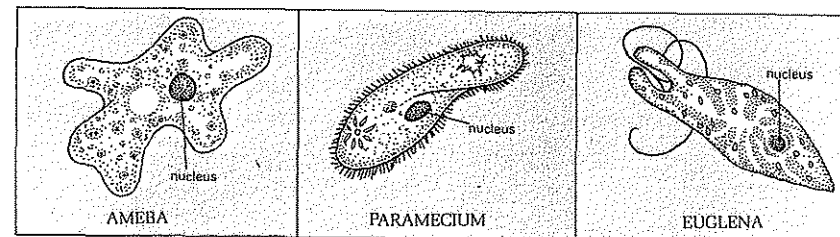
Algae have chlorophyll. They make their own food. Algae are not part of the plant kingdom because they do not have the special parts that most plants have.

FUNGI [FUN jy] are plant-like in some ways. Like plants, fungi are made of many cells. The cells have an outer wall similar to the cell wall of plant cells. But fungi do not have chlorophyll. They do not make their own food.

Fungi do not have true roots, stems, or leaves. They absorb, or take in, food from their surroundings. Fungi get their food from other living things or from dead organisms.

SLIME MOLDS are similar to fungi. But there are important differences in their life cycles. That is why they are studied separately. Slime molds do not make their own food.

PROTOZOANS



Three common protozoans are shown above. Use these illustrations and what you have read to answer the questions below.

- Protozoans are _____
plants, animals, not plants or animals
- Protozoans are _____ -celled organisms.
single, many
- Do most protozoans make their own food? _____
yes, no
- Do most protozoans move by themselves? _____
yes, no
- Do protozoans have a cell wall? _____
yes, no
- Look carefully at each nucleus. The nucleus of a protozoan
 - has a definite border. _____
yes, no
 - is spread out and has no definite border. _____
yes, no

ALGAE

Algae are found almost everywhere. . . .

- You may have seen algae as a green scum on a quiet pond or lake.
- The green "fuzz" on some moist soil and rocks is algae. Be careful. Don't walk on algae-covered rocks. They are very slippery.
- Have you ever seen green water in a swimming pool? The green in the water is algae. Some swimming pools have a real "algae problem."

Algae also grow in hot springs and on snow. Algae has even been seen on glaciers and icebergs.

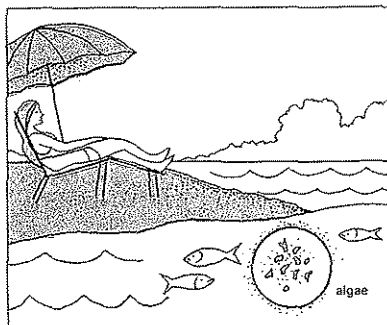
Most algae are found in the oceans.

How important is this? As important as life itself. . . . Most of the oxygen we breathe comes from sea algae.

FUNGI

Have you ever eaten a fungus?

You have if you have eaten mushrooms! Mushrooms are one of the many varieties of fungi.



CAREFUL: Never eat wild mushrooms you may find. They may be poisonous!

Answer the questions below.

1. Do fungi have true roots, stems, or leaves? _____
yes, no
2. a) Do fungi make their own food? _____
yes, no
- b) Why or why not? Explain your answer in a brief sentence. _____

3. How do fungi obtain their food? _____

SOME INTERESTING FACTS ABOUT SLIME MOLDS

Have you ever seen the movie, *The Blob*? During part of its life cycle, a slime mold looks like a slimy, shapeless "blob."

A slime mold does not make its own food. It "oozes" over the forest floor in search of food. A slime mold absorbs its food.



Slime molds are unique. A slime mold may be made up of many cells, or it may not have any cells at all. Sometimes, slime molds are nothing more than a mass of cytoplasm containing thousands of nuclei.

Which other protists are usually studied with the slime molds? Circle the letter of the correct answer.

- a) bacteria
- b) protozoans
- c) fungi
- d) algae

THE WORLD OF PROTISTS

You are looking through a microscope. . . . Well, not really! But imagine that you are.

Figure E shows you what you are "seeing"—15 kinds of protists.

Anton van Leeuwenhoek [AN tun van LAY vun hook] was a pioneer microscope-maker. He lived more than 300 years ago. Van Leeuwenhoek was the first person to see these tiny organisms. Guess what he called them? "Wee beasties!" Now, they have fancy scientific names.

Can you identify these protists from their descriptions? Sure you can! It's easier than you think. BUT, there is a C-A-T-C-H. Pronouncing some of the names won't be easy. Almost everyone has trouble . . . even your teacher. So don't be discouraged. In fact, it should be lots of FUN!

READY. . . . SET. . . . GO!

Write the letter of each protist in the correct space in the chart.

	Scientific Name	Looks Like	Letter
1.	diatom	a triangle	
2.	heteronema	a snail	
3.	protochrysis	a kidney bean	
4.	chlamydononas	a drop with whiskers	
5.	paramecium	a footprint	
6.	vorticella	a flower with a telephone cord for a stem	
7.	loxodes	a cucumber with a bite taken out	
8.	radiolarian	a lacy snowflake	
9.	lacrymaria	a swan	
10.	anarma	a purse with hairy corners	
11.	heliozoan	a fancy sun	
12.	spirogyra	a tube with coiled worms inside	
13.	forminiferan	a bunch of hairy grapes	
14.	glenodinium monensis	a hamburger	
15.	trachelocerca conifer	a baseball bat	

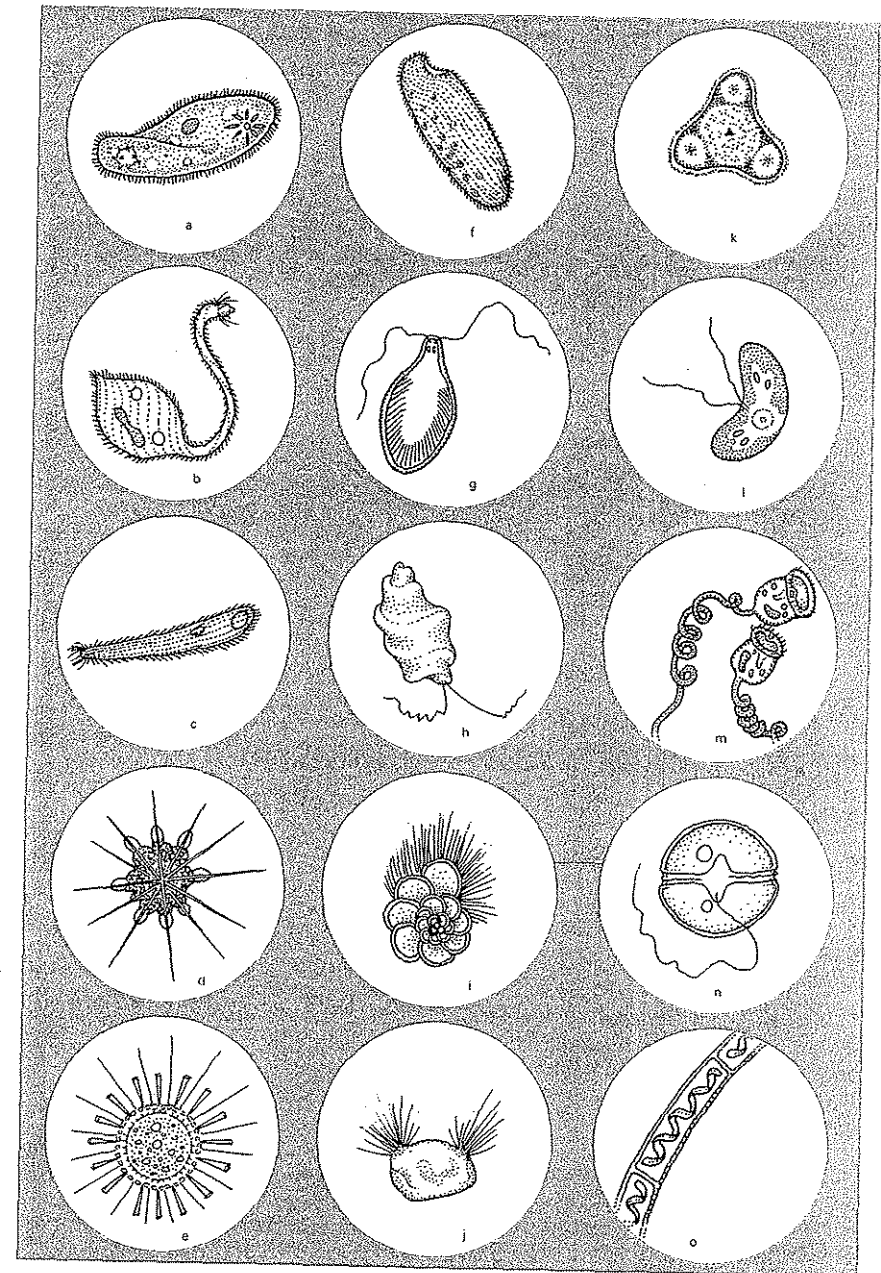


FIGURE E The World of Protists

COMPLETING SENTENCES

Complete the sentences with the words below. Six of these may be used twice.

animal
algae
protozoa
oceans

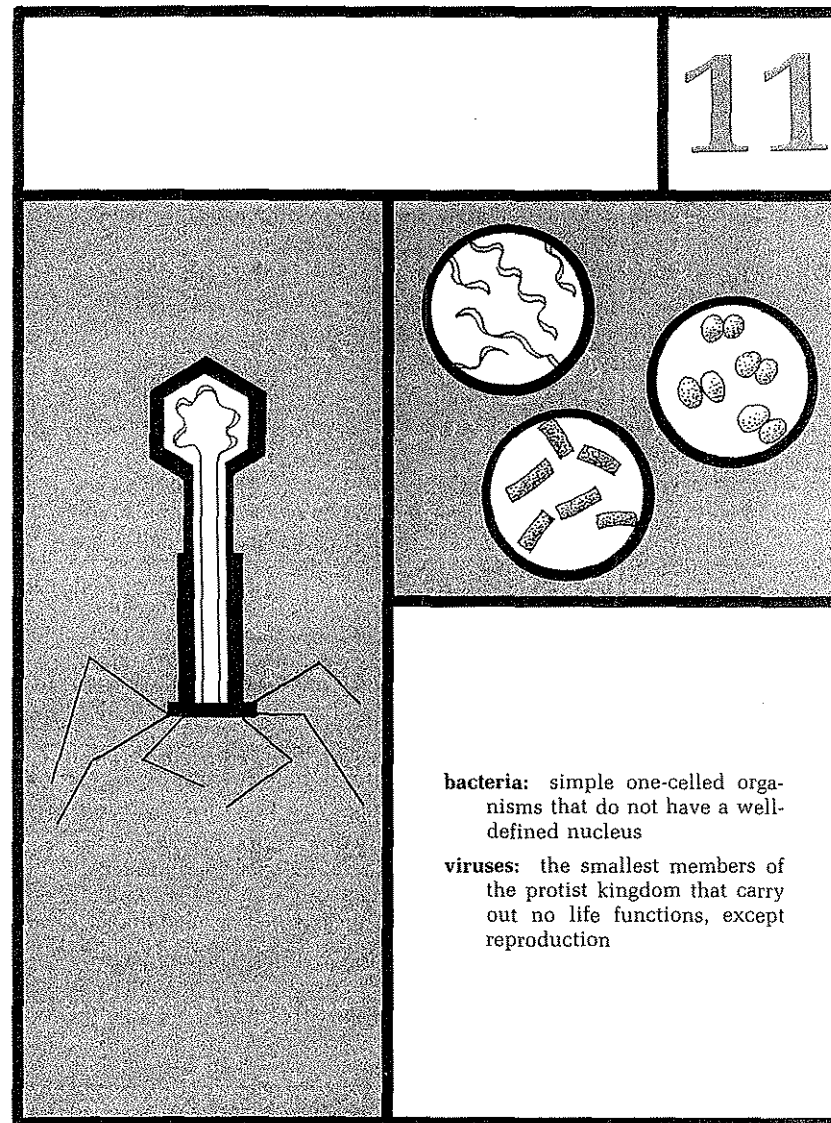
do not agree
protist
viruses
oxygen

bacteria
plant
slime molds
fungi

1. Scientists _____ about the number of classification kingdoms.
2. In this book, we study three kingdoms. They are the _____, _____, and _____ kingdoms.
3. Organisms that are not clearly plants or animals are included in the _____ kingdom.
4. Members of the protist kingdom include: _____, _____, _____, and _____.
5. Simple, animal-like protists are _____.
6. The simple plant-like protists that make their own food are _____.
7. The protists that are similar to fungi are the _____.
8. Protists that eat other living things or dead organisms are _____.
9. All of the members of the _____ kingdom make their own food.
10. Most of the _____ in our air comes from algae that live in the _____.

WHAT ARE BACTERIA AND VIRUSES?

11



AIM | What are bacteria and viruses?

11

BACTERIA

Bacteria are one-celled organisms. They are among the smallest and simplest living things. We know they are alive because they carry out all the life functions.

Look at the period at the end of this sentence. How many bacteria do you think can fit on it? Would you believe from fifty thousand to one-quarter million?

Bacterial cells are unique. They do not have a definite nucleus. The chemical that normally makes up a nucleus is spread throughout the cytoplasm.

Bacteria have a cell wall. In this way, they are like plants. But most bacteria do not have chlorophyll. They cannot make their own food. In this way, they are like animals.

Most bacteria can't move by themselves. They are carried by air or moving water. Some bacteria, however, can move by themselves. One type moves using a hairlike structure called a *flagellum* [fluh JEL um].

Bacteria are found everywhere. They live in the oceans, in the air, and in the soil. They are in the water you drink and the food you eat. Bacteria cover your skin. You even have bacteria living in your mouth, in your blood, and in your intestines!

VIRUSES

Alive or not alive? That is the question! Scientists do not agree about whether viruses are actually living things.

Viruses are unusual. A virus has no cell parts. It does not ingest or digest food. It does not carry out respiration. In fact, a virus does not carry out any life function—except reproduction—and then, only when it is living inside another living cell. When a virus is outside a living cell, it is just a "chemical."

Viruses are ultra-small. Bacteria are tiny. Yet, compared to viruses, bacteria are giants! Think of this. . . a single microscopic cell may contain millions of virus particles.

MORE ABOUT BACTERIA

Bacteria [sing. bacterium (bak TEER ee um)] are found in three basic shapes. They may be round, rod-shaped, or spiral.

- A round bacteria is called a coccus [sing. KAHK us (pl. cocci KAHK sy)].
- A rod-shaped bacterium is called a bacillus [sing. buh SIL us (pl. bacilli buh SIL ly)].
- A spiral-shaped bacterium is called a spirillum [sing. spy RIL um (pl. spirilla spy RIL luh)].

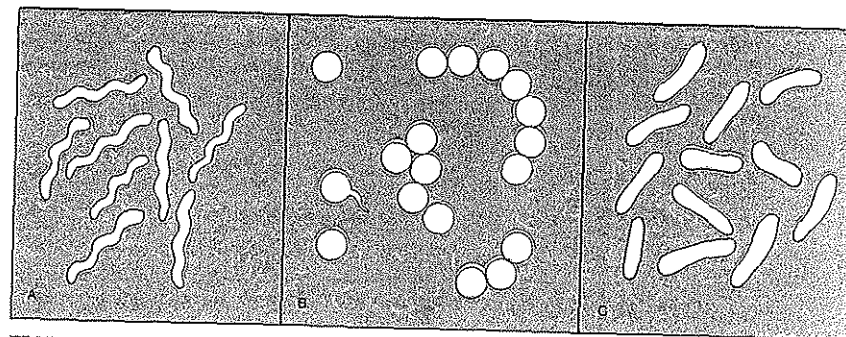


FIGURE A

I. Look at Figure A above. Use letters to answer the following questions.

1. Which illustration shows
 - a) cocci? _____
 - b) spirilla? _____
 - c) bacilli? _____
2. One of these bacteria can move by itself. . . .
 - a) Which one? _____
 - b) Why can this bacterium move by itself? _____
 - c) Draw a picture of this bacteria in the space below. _____
3. a) Are bacteria living things? _____
- b) Why or why not? _____

BACTERIA CAN BE HELPFUL

- Some bacteria are used in making foods like cheeses, yogurt, vinegar, and sauerkraut.
- You have bacteria living in your digestive tract! These bacteria help digestion.

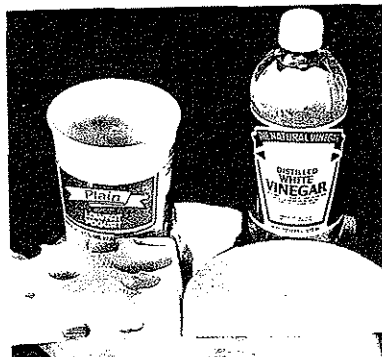


FIGURE B

- Some bacteria break down dead matter. When a plant or animal dies, bacteria of decay break down the organism into simpler substances. These substances often serve as nutrients for living organisms.

BACTERIA CAN BE HARMFUL

- Some bacteria cause diseases in humans, plants, and animals. Tuberculosis, pneumonia, and strep throat are three diseases caused by bacteria.
- Bacteria are also responsible for food poisoning.



FIGURE C

GROWING BACTERIA

What You Need

sterile agar in 4 sterile covered petri [PEE tree] dishes.

What To Do

1. Number each petri dish. Petri dishes should be numbered on the sides or on the bottoms. Keep a record of what to do.
2. Petri dish # 1: Open the cover quickly and sprinkle some dust or fine soil on the dish. Quickly close the cover.

Petri dish # 2: Open the petri dish quickly. Cough into the petri dish, then quickly replace the cover.

Petri dish # 3: Quickly open the petri dish. Wait a few seconds, then replace the cover.

Petri dish # 4: Do nothing. Most importantly, *do not* remove the cover.

3. Place all 4 petri dishes in a warm dark place for 2 days. Then observe each petri dish.

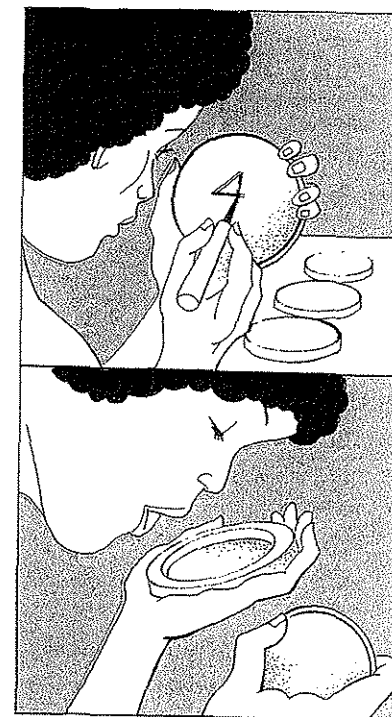


FIGURE D

What You Saw and Learned

1. Which petri dishes showed signs of bacterial growth? _____
2. a) Which petri dish showed no sign of bacterial growth? _____
b) Why was there no growth? _____
3. Why should a petri dish not be numbered (or labeled) on the cover? _____
4. Why do bacteria grow in agar? _____

MORE ABOUT VIRUSES

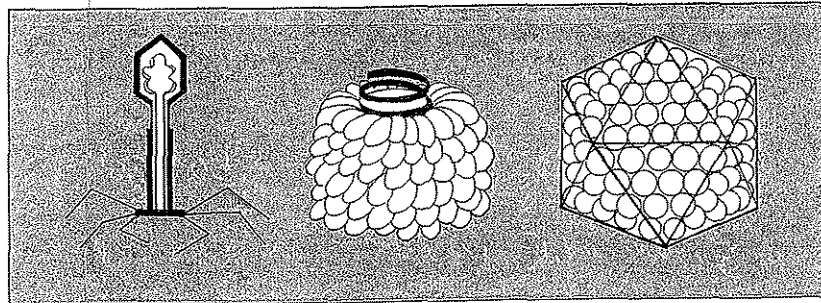


FIGURE E

1. Do most scientists believe viruses are living things? _____
2. a) What is the only life function that a virus carries out? _____
- b) When is the only time this life function can take place? _____

II.

Viruses cause many human, plant, and animal diseases—like polio and the flu.

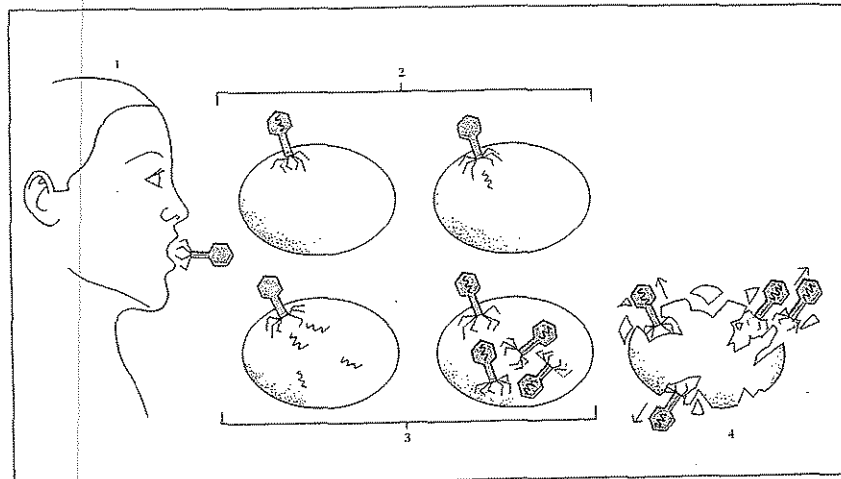


FIGURE F

How a Flu Virus Spreads in People

As you read about how a flu virus spreads in people, look back to Figure F. See if you can follow the sequence of events on the illustration.

1. The virus enters the nose or mouth.
2. The virus attaches to a cell. The "body" chemical of the virus enters the cell.
3. The chemical "takes over" the cell. It uses the cell material to reproduce. This kills the cell.
4. The cell bursts open. The new viruses are released. They enter other cells. And the process starts over and over again. The person becomes ill. Flu symptoms develop.
5. The ill person sneezes or coughs into the air. Some viruses enter the air. Other people breathe the viruses in. . . . WHAT DO YOU THINK HAPPENS NEXT?

MATCHING Match the two lists. Write the correct letter on the line next to each number.

- | | |
|--|---|
| 1. _____ viruses and bacteria | a) reproduction is their only life function |
| 2. _____ viruses | b) microscopic protists |
| 3. _____  | c) bacilli |
| 4. _____  | d) cocci |
| 5. _____  | e) spirilla |

COMPLETING SENTENCES

Complete the sentences with the words below. One word may be used twice.

spiral
breaking down dead organisms
living organisms
cocci
reproduction

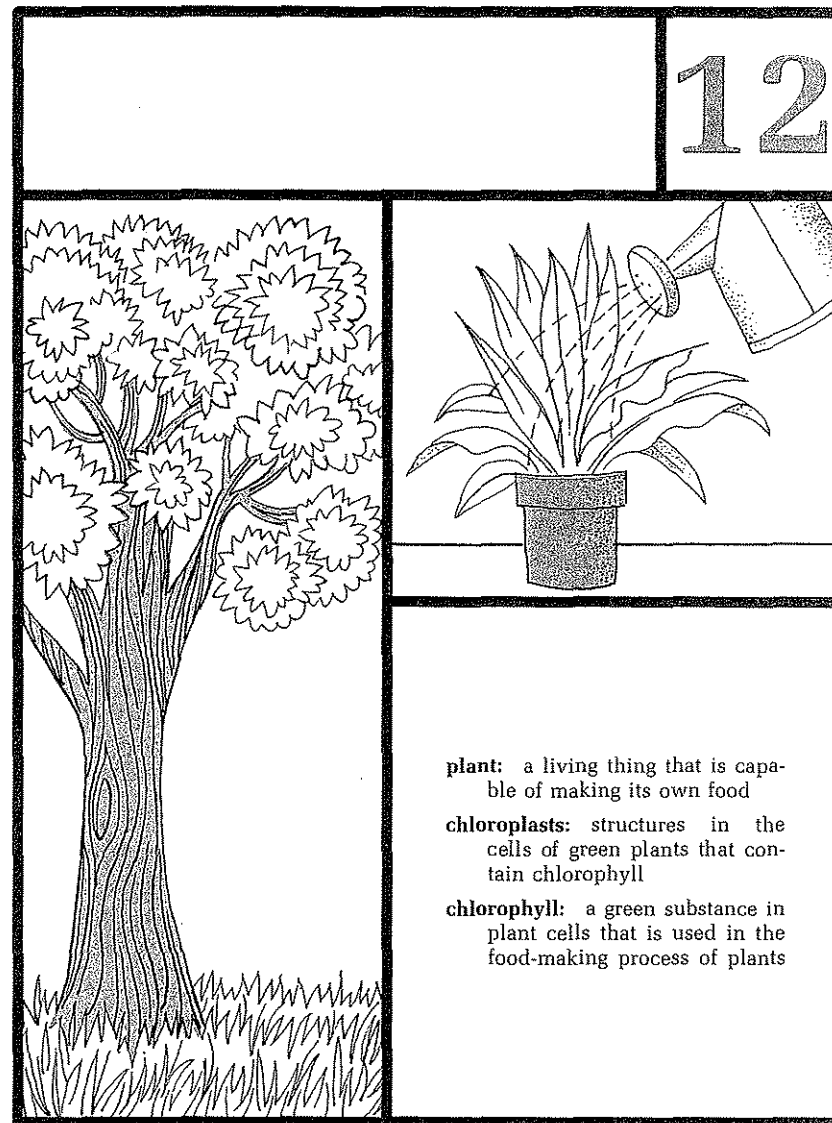
spirilla
smaller
diseases
bacteria
round

viruses
rod
living cell
bacilli
life function

- The microscopic organisms studied in this aim were _____ and _____.
- Bacteria are definitely _____ because they carry out all the _____.
- Scientists are not sure if _____ are living things.
- The only life function viruses can carry out is _____.
- A virus can reproduce only when it is inside a _____.
- Viruses are much _____ than bacteria.
- The three shapes of bacteria are _____, _____, and _____.
- Round bacteria are called _____. Rod-shaped bacteria are called _____. Spiral bacteria are called _____.
- Bacteria and viruses can cause many human, plant, and animal _____.
- One way that bacteria can be helpful is by _____.

WHAT ARE PLANTS?

12



AIM | What are plants?

12

Plants are pretty to look at. We decorate our homes with them. We work hard to grow gardens and thick lawns. We give flowers to loved ones.

Plants give us pleasure, but they are even more important. Without plants, there could be no life on Earth!

Plants give us oxygen. They also give us food. In fact, all of the food we eat comes from plants—either directly or indirectly.

Some animals eat plants, like grasses, grains, fruits, or vegetables, directly. Other animals eat meat. But what is meat? Meat is really changed-over plants.

Think about a steak or a lamb chop. These meats come from cows and sheep. Cows and sheep eat grasses and other plants. During digestion, these plants are changed in form. They become meat like steaks and chops.

Even the milk we drink is changed-over grass. Clearly, without plants there would be no food—and no life!

Plants are living things. But so are animals and protists. What makes a plant different from other living things? These are some of the main differences.

1. Plants make their own food. The cells of green plants contain structures called *chloroplasts*. Chloroplasts contain the green substance, *chlorophyll*. Chlorophyll is needed for a plant to make its own food.

Most food-making takes place in the leaves of green plants. This is where most of the chlorophyll is found. The leaf of the plant can be thought of as the plant's "food-factory."

2. Plant cells are surrounded by a rigid *cell wall*. This cell wall is made of a nonliving substance called *cellulose*. The cell wall helps give a plant its stiffness.

3. Plants generally do not move freely from place to place.

PLANT PHYLA

The plant kingdom is divided into two large groups (phyla)—the *vascular* [VAS kyuh lar] plants and the *nonvascular* plants.

■ Vascular plants belong to the phylum *Tracheophyta* [TRAY kee oh FYT uh]. All of the plants in this phylum have a vascular system. A vascular system is a system of connecting tubes. These tubes carry water and dissolved nutrients to all parts of the plant.

The vascular plants are the most complex plants. Most of the plants you know belong to this group of plants. The vascular plants include trees, flowers, grasses, fruits, and vegetables.

■ Nonvascular plants belong to the phylum *Bryophyta* [BRY uh FYT uh]. The plants in this phylum are very simple. Nonvascular plants do not have true roots, stems, or leaves. They also have no tube system.

Examples of nonvascular plants include the mosses and liverworts. You have probably seen moss. It grows in moist, shaded areas. It is commonly found on the soil under trees, in sidewall cracks, and on walls.

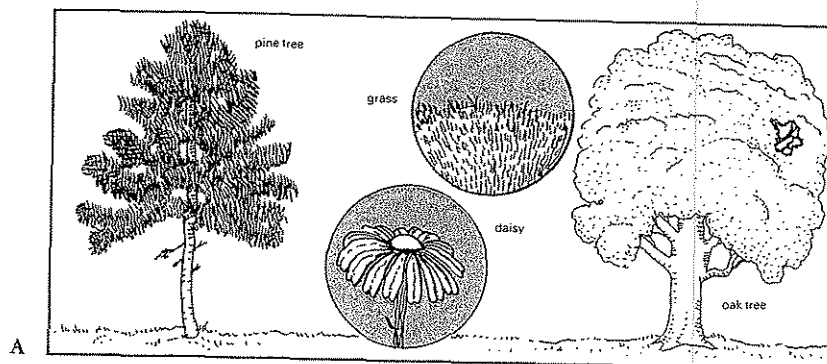


Figure A shows some common plants. Study the diagram. Then answer the questions.

1. a) They are _____ plants.
vascular, nonvascular
- b) They _____ have a tube system to transport water.
do, do not
2. These plants belong to the phylum _____.
Bryophyta, Tracheophyta
3. Do Tracheophytes have true roots, stems, and leaves? _____.
yes, no
4. Tracheophytes are _____ plants.
simple, complex

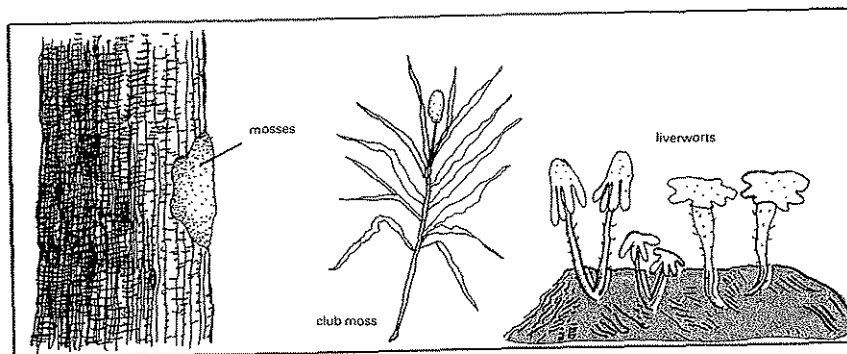


FIGURE B

5. Name the plants shown in Figure B. _____
6. They are _____ plants.
vascular, nonvascular
7. These plants belong to the phylum _____
Bryophyta, Tracheophyta
8. Do Bryophytes have true roots, stems, and leaves? _____
yes, no
9. Bryophytes are _____ plants.
simple, complex
10. Mosses and liverworts are examples of _____
Bryophytes, Tracheophytes

MATCHING Match the two lists. Write the correct letter on the line next to each number.

- | | |
|-----------------------------------|---|
| 1. _____ leaf | a) cell parts needed for photosynthesis |
| 2. _____ chloroplasts | b) gives plants stiffness |
| 3. _____ carbon dioxide and water | c) controls all cell activities |
| 4. _____ cell wall | d) a plant's food factory |
| 5. _____ nucleus | e) raw materials used in photosynthesis |

COMPLETE THE CHART

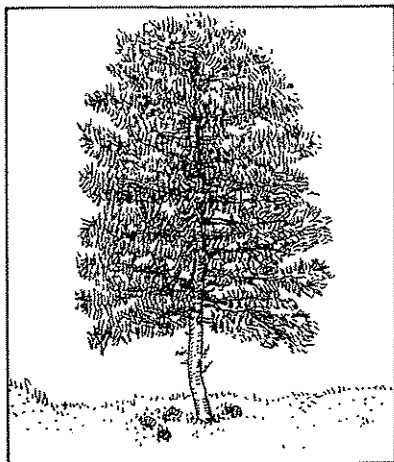
Some of the characteristics listed in the chart below are true of Tracheophytes only. Some are true only of Bryophytes. Some of the characteristics are found in Tracheophytes and Bryophytes.

Complete this chart. Place a check in the proper column for each characteristic.

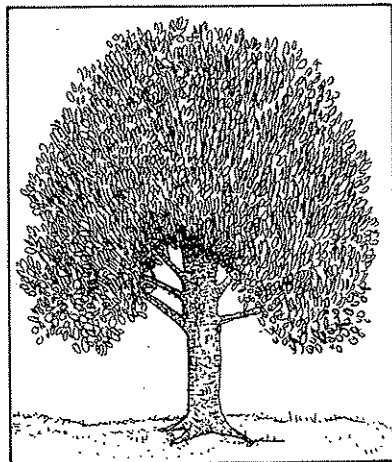
		PHYLUM	
		Tracheophyta	Bryophyta
1.	vascular plants		
2.	cells covered by cell walls		
3.	nonvascular plants		
4.	no tube system		
5.	cells contain chloroplasts		
6.	tube system		
7.	true roots, stems, and leaves		
8.	no true roots, stems, or leaves		
9.	mosses		
10.	trees		
11.	very simple plants		
12.	more complex plants		
13.	liverworts		
14.	flowers and vegetables		
15.	grasses		

**BRYOPHYTE
OR TRACHEO-
PHYTE?**

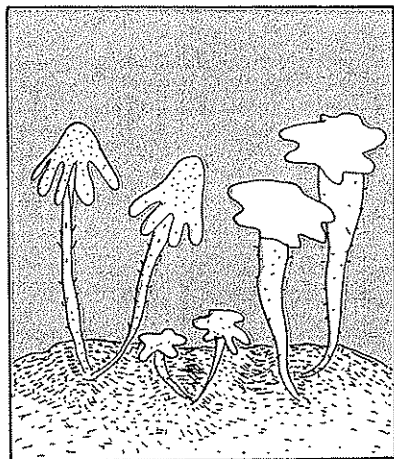
Look at the plant in each of the pictures. Label each plant as a bryophyte or a tracheophyte. Write your answer on the line below each picture.



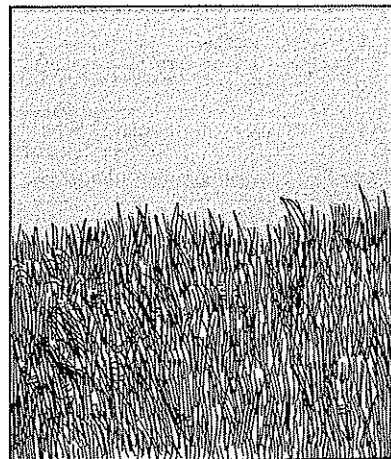
1. _____



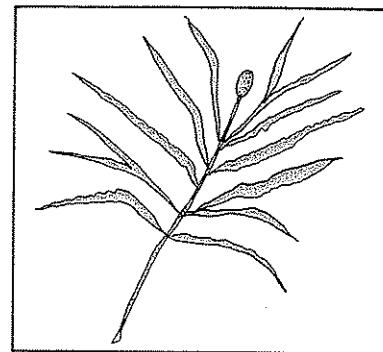
2. _____



3. _____



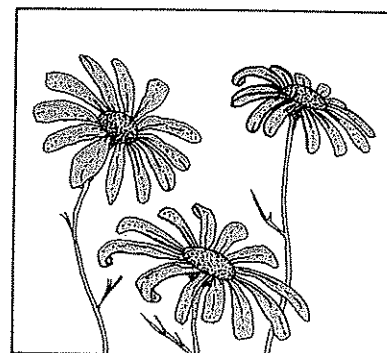
4. _____



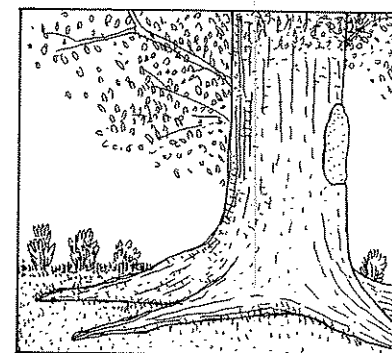
5. _____



6. _____



7. _____



8. _____

9. Trees, grasses, flowers, and vegetables are bryophytes, tracheophytes

10. Mosses and liverworts are examples of bryophytes, tracheophytes

COMPLETING SENTENCES

Complete the sentences with the words below. Two words will be used twice.

dissolved nutrients
milk
roots
oxygen
cell wall

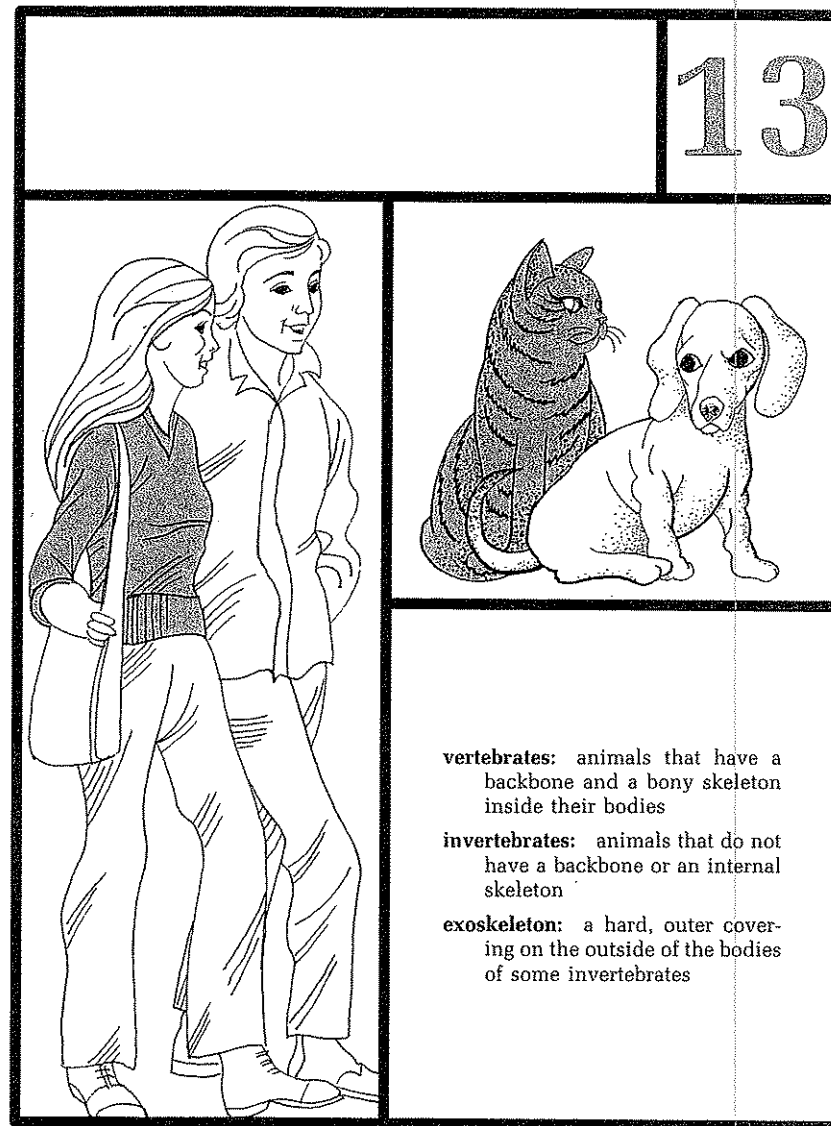
meat
leaves
complex
move
water

do not
food
stems
vascular
chloroplasts

1. There can be no life without plants. Plants give us _____ and _____.
2. Animals, like the cow, convert grass and other plants to _____ and _____.
3. a) Plants make their own _____.
b) Animals _____ make their own food.
4. Plant cells have a stiff outer covering called a _____.
Plant cells also contain structures called _____.
5. Plants do not usually _____ about as freely as animals.
6. A _____ system is a system of connecting tubes.
7. In some plants, _____ and _____ are carried throughout the plant by a vascular system.
8. Vascular plants are more _____ than nonvascular plants.
9. Vascular plants have true _____, _____, and _____.
10. Nonvascular plants _____ have true roots, stems, or leaves.

WHAT ARE ANIMALS?

13



AIM | What are animals?

13

Animals can be found almost everywhere. They live in very hot places, and in very cold places. They live in the deep ocean, and on high mountains. Some animals live even in the ground!

Some animals are very small. You need a microscope to see them. Others, like the whale and the elephant, are huge.

Differences among animals can be great. But all animals are alike in certain ways.

- Animals do not make their own food. They can't. They have no chlorophyll in their cells. Animals must take in food from the outside.

- Animal cells do not have a cell wall.

- Most animals move about from place to place.

Animals are classified into two major groups—vertebrates [VUR tuh brayts] and invertebrates.

- Vertebrates have bony skeletons inside their bodies. The most important part of this internal skeleton is the backbone. The backbone protects the spinal cord. It also helps support the animal.

People are vertebrates. So are dogs, cats, frogs, and birds. How many other vertebrates can you think of?

- Invertebrates do not have an internal skeleton. They do not have a backbone. Some invertebrates, such as the grasshopper, have a hard outer covering called an exoskeleton. An exoskeleton helps to support the animal. It also helps protect the animal from injury.

Examples of invertebrates include lobsters, sponges, worms, jellyfish, and insects. About 95 percent of all animals are invertebrates.

I. Check the reading on page 100 to answer the questions below.

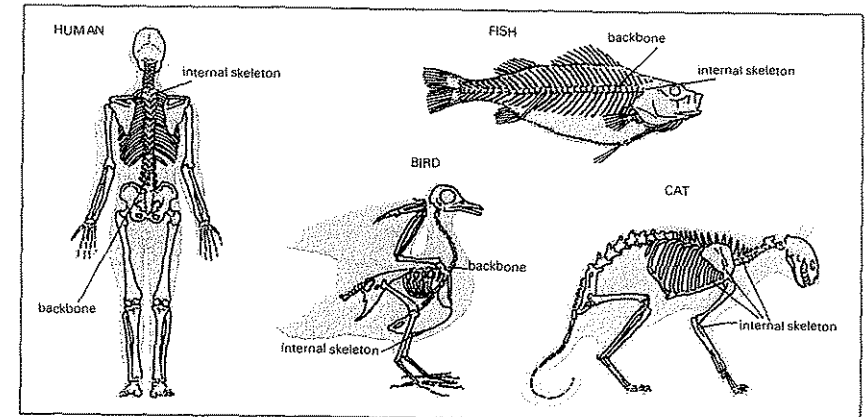


Figure A

- Look at Figure A. These animals are _____
vertebrates, invertebrates
- a) What does each of these animals have running down the middle of its back?

- b) This is found on the _____ of the body.
inside, outside
- The backbone is part of an internal _____.
- Any animal with a backbone and an inside skeleton is classified as
_____ an invertebrate, a vertebrate

NOW TRY THIS!

You can feel your backbone.

To find your backbone, run your fingers up the center of your back.

How far up and down your back does your backbone go? _____

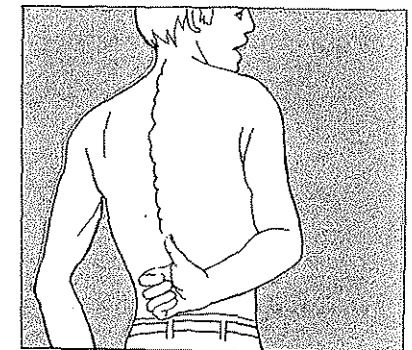


Figure B

II. Look at Figure C. Then answer the questions.

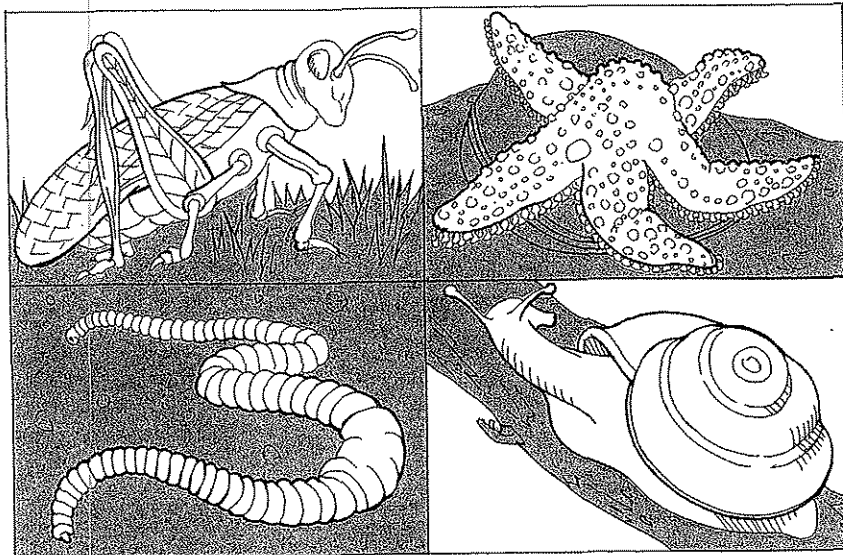


Figure C

1. Do these animals have a backbone? _____
yes, no
2. Do these animals have an internal skeleton? _____
yes, no
3. Do any of these animals have an exoskeleton? _____
yes, no
4. These animals are _____
vertebrates, invertebrates

- III. 5. Do animals make their own food? _____
yes, no
6. What kind of organisms make their own food? _____

CLASSIFICATION OF VERTEBRATES

Vertebrates and invertebrates are divided into smaller groups (phyla). The chart below lists the phyla of vertebrates. Study the chart.

COMMON NAME	EXAMPLES	IMPORTANT CHARACTERISTICS
FISH		- live entirely in water - obtain dissolved oxygen from water through gills - cold-blooded - bodies covered with scales - most lay eggs
AMPHIBIANS [am FIB ee uns]		- live part of their lives in water and part on land - can breathe in water or on land - cold-blooded - smooth skin - lay eggs
REPTILES		- live mainly on land - breathe air - cold-blooded - body covered with hard plates or scales - most lay eggs
BIRDS		- live on land - breathe air - warm-blooded - body covered with feathers - have lightweight bones - lay eggs
MAMMALS		- most live on land - breathe air - warm-blooded - body covered with fur or hair - young develop entirely inside mother's body (most produce live young) - produce milk to nurse their young

COLD-BLOODED AND WARM-BLOODED ANIMALS

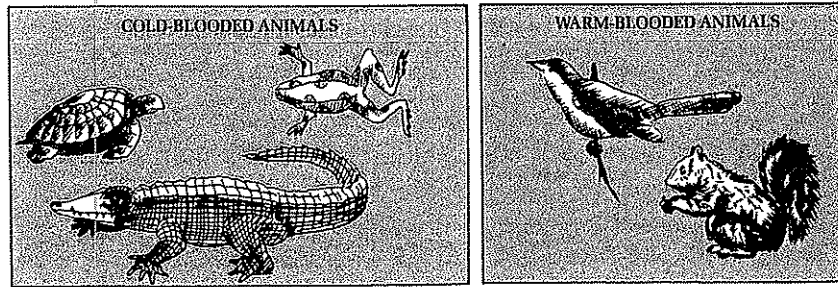


Figure D Some vertebrates are cold-blooded animals. Others, are warm-blooded.

- The body temperature of a cold-blooded animal changes with the temperature of the animal's surroundings.
- The body temperature of a warm-blooded animal stays about the same all the time. A warm-blooded animal's temperature does not change when the temperature of its surroundings changes.

Use the chart on page 103 to answer these questions about vertebrates.

1. Which are the only vertebrates that
 - a) have hair? _____
 - b) have feathers? _____
 - c) can breathe on land and in water? _____
 - d) feed milk to their babies? _____
2. Which vertebrates are
 - a) warm-blooded? _____
 - b) cold-blooded? _____
3. a) The body temperature of a warm-blooded animal _____ change according to the outside environment. does, does not
- b) The body temperature of a cold-blooded animal _____ change according to the outside environment. does, does not
4. Which vertebrates breathe only in water through gills? _____
5. Which vertebrates are covered with tough plates or scales? _____

CLASSIFICATION OF INVERTEBRATES

COMMON NAME	EXAMPLES	IMPORTANT CHARACTERISTICS
SPONGES		• has many pores (holes) through which water flows • live in fresh water and in salt water
JELLYFISHES		• saclike bodies • all have stinging cells; some have tentacles • live in water
FLATWORMS		• long, flat, ribbonlike bodies • most get food by attaching to another organism and absorbing food from that organism
ROUNDWORMS		• long, thin, tubelike bodies with no segments • most get food by attaching themselves to another organism and absorbing food from that organism
SEGMENTED [SEG ment ud] WORMS		• long tubelike body that is divided into segments (sections) • simplest organisms with a true nervous system
MOLLUSKS [MAHL usks]		• soft bodies • many have shells • live in salt water, fresh water, and on land
STARFISH and RELATIVES		• have similar parts (like arms) that extend from middle body section • have tube feet and spines
ARTHROPODS [AR thruh pods]		• have jointed legs • live on land and in water • have a hard outer covering • have segmented bodies • some have wings

What do invertebrates not have that vertebrates do have? _____

ABOUT ARTHROPODS

You probably don't normally think of insects as animals. BUT insects are animals. Insects are just one of the groups of animals that belong in the arthropod phylum.

Arthropods make up the largest phylum in the animal kingdom. In addition to insects, this phylum also includes animals such as lobsters, spiders, centipedes, and ticks.

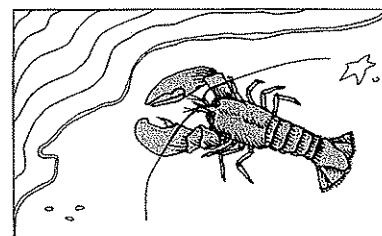
Look at the chart below. The chart lists the major groups of arthropods. It also lists their important characteristics.

COMMON NAME	IMPORTANT CHARACTERISTICS
Centipedes	Centipedes have many body sections. Each body section has one pair of legs.
Millipedes	Millipedes have many body sections. Each body section has two pairs of legs.
Crustacea [krus TAY shuh] Includes: lobsters, shrimp, crabs, and crayfish.	All crustacea have a hard exoskeleton, five pairs of legs, and two pairs of antennae.
Spiders	Spiders have two body sections and four pairs of legs (total).
Insects	Insects have three body sections and three pairs of legs.

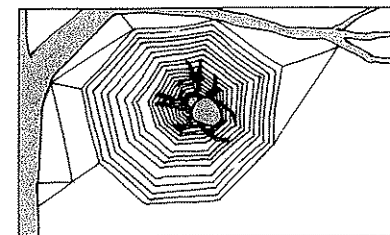
INTERESTING FACTS ABOUT ARTHROPODS

1. Insects are by far the largest single group of invertebrates. There are so many insect species that scientists are not really sure how many different insects there are.
2. Nearly one million insect species have been classified. The total number of insect species may be closer to four million. And, each species contains billions of members. Can you imagine how many insects there are all together?
3. You may be surprised to learn that the lobster, shrimp, and blue crab are arthropods—just as centipedes, millipedes, and insects are.

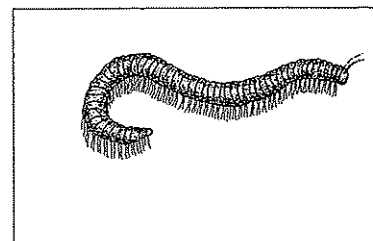
CLASSIFY THE ARTHROPODS Look at the pictures of the arthropods below. What arthropod group does each organism belong to? Write the name of the group on the line below each picture.



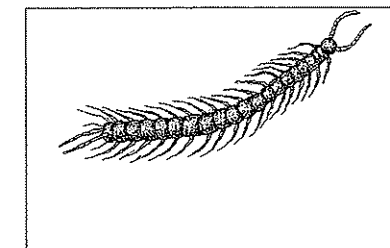
1. _____



2. _____



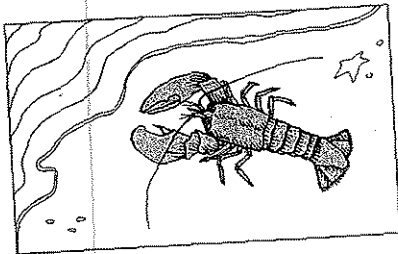
3. _____



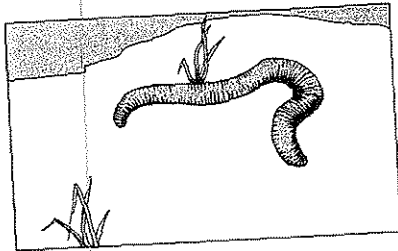
4. _____

**VERTEBRATE
OR
INVERTEBRATE?**

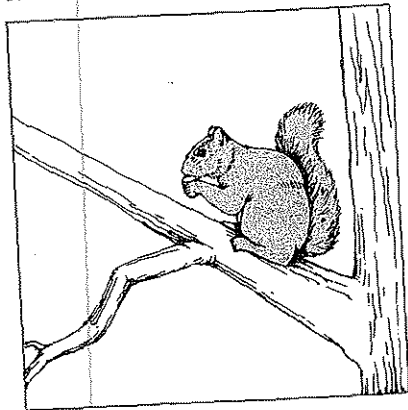
Without looking back, label each of the animals shown below as a vertebrate or invertebrate. Write your answer in the space below each picture.



1. _____

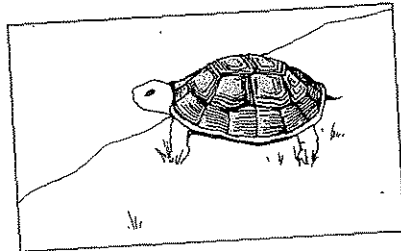


3. _____

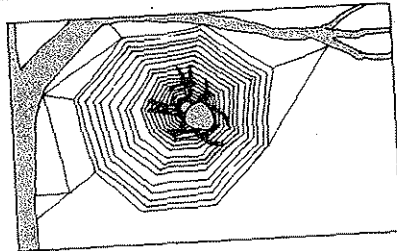


5. _____

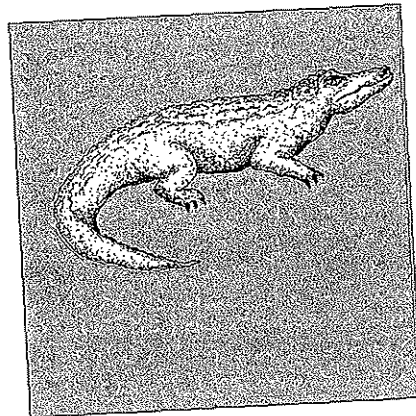
108



2. _____



4. _____



6. _____

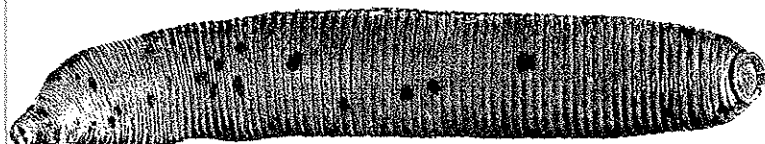
PLANT OR ANIMAL?

Put a check in the correct box or boxes next to each characteristic.

	CHARACTERISTIC	PLANTS	ANIMALS
1.	living organisms		
2.	cells do not have chlorophyll		
3.	cells have no cell wall		
4.	make their own food		
5.	cells have chlorophyll		
6.	very limited movement		
7.	cells have a cell wall		
8.	take in food from outside		
9.	move about from place to place		
10.	carry out every life function		

KEEPING UP WITH SCIENCE

BLOOD-LETTING



IN MEDICINE

We often hear of ill people receiving blood. But did you ever hear of blood being taken from an ill person?

The removal of blood for health reasons is called *bleeding*, or *blood-letting*. Blood-letting was practiced in Europe for centuries. It was supposed to cure all sorts of illnesses. "Bad" blood was let out, so "good" blood could take its place.

In one type of blood-letting, a pint or more of blood was removed from a large blood vessel. Often, the process was repeated within a day or less. This type of bleeding probably killed many patients. Certainly, even more were made anemic.

Another kind of blood-letting used worms called *leeches* or *bloodsuckers*. Leeches are placed upon the skin where blood is to be removed. A leech has three sharp teeth. They painlessly saw through the skin. The leech then sucks a small amount of blood through the wound.

Leeches were used widely to remove blood under the skin that causes "black eyes." And, like bleeding letting, leeches were also used in the hope of curing many illnesses.

Many early American doctors prac-

ticed bleeding. One strong supporter was Dr. Benjamin Rush, a signer of the Declaration of Independence.

Not long ago, the use of medical leeches had just about disappeared. But recently, new uses for them has been found.

In many cases, doctors can reattach a severed finger. Often, however, the surgeons cannot reconnect the tiny blood vessels at the finger tip. The blood can build up and clot beneath the fingernail. The clot then stops the blood from flowing. If this happens, the cells in the area die. So does the reconnected finger.

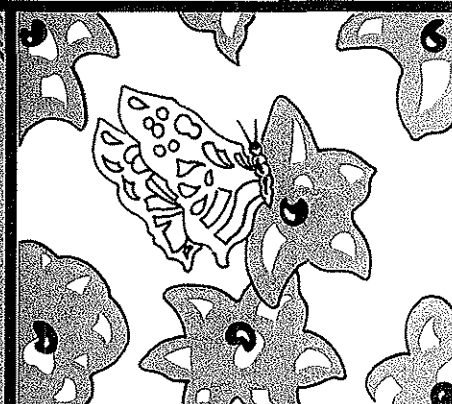
To prevent this, leeches are placed upon the finger. They suck up enough blood to prevent its build up. In time, the body makes new blood vessels to drain the blood naturally.

Physicians are now using leeches to remove blood clots following plastic surgery and skin grafts.

Many years ago most doctors rejected almost all forms of blood-letting. Now, one wonders what new uses may be found for this ancient and "primitive" treatment.

WHAT IS ECOLOGY?

14



ecology: the study of the relationship between living things and their environment

ecosystem: the living and nonliving parts of a specific environment

community: all of the organisms that share an environment

habitat: the place where an organism lives

AIM | What is ecology?

14

Our planet is huge. It has an area of more than 500 million square kilometers (200 million square miles). Yet life exists only on its surface—and slightly above and below. We call this narrow zone of life the *biosphere* [BY uh sfeer].

The biosphere is teeming with all kinds of life—plant, animal, and protist. These organisms live in all kinds of environments. Usually, many species share the same environment. These organisms make up a *community*.

Members of a community depend upon each other. They also depend upon nonliving things like air, light, and water. The living and nonliving parts of the environment are always interacting. And a change in one part can cause a change in all the parts.

The study of the relationship between living things and their environment is called *ecology* [ih KOL uh jee]. The living and nonliving parts of a specific environment make up an *ecosystem*.

An ecosystem can be large, like an ocean or a jungle. Or it can be small, like a pond or a patch of grass in an empty lot. Even a home aquarium is an ecosystem!

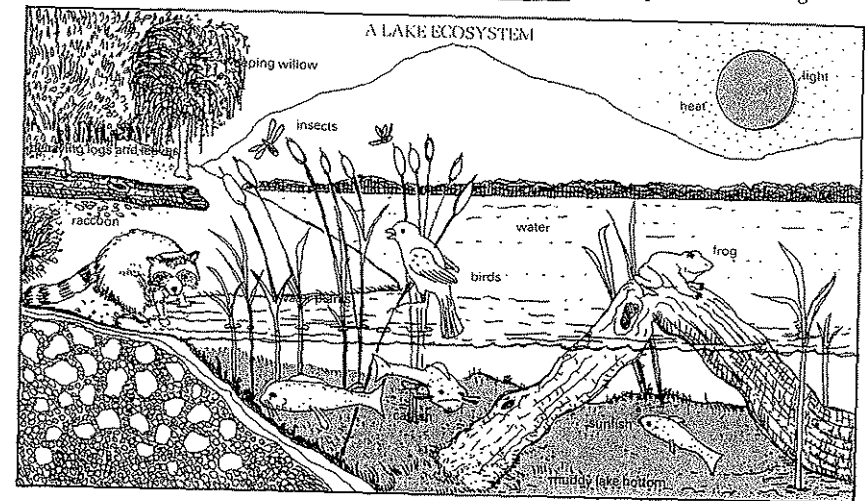
Only certain organisms can live in a given ecosystem. For example, a whale cannot live in a desert ecosystem. Bananas can't grow in the arctic.

Many species may share an ecosystem. But each species lives in a special place within that ecosystem. This place is called its *habitat*.

Birds and earthworms may share the same forest ecosystem. But their habitats are very different. For example, trees are the habitats for most birds. An earthworm's habitat is the soil.

STUDYING ECOSYSTEMS

I. Figure A shows a lake ecosystem. The parts of this ecosystem are listed below. Next to each part, write living, if it is living. Write not living, if the part is not living.

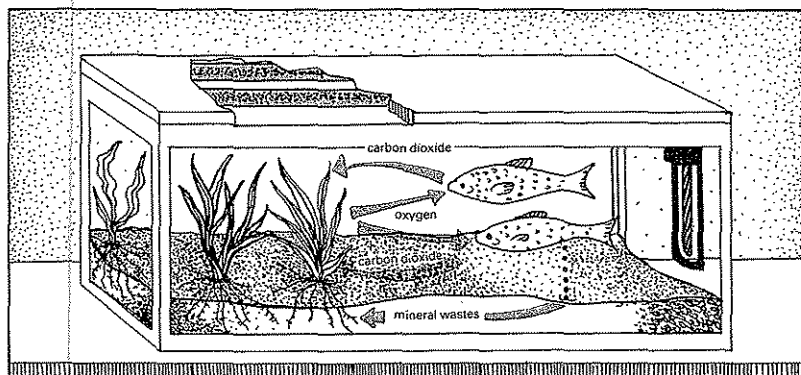


- | | |
|---|---|
| 1. light _____ | 9. frog _____ |
| 2. catfish _____ | 10. muddy lake bottom _____ |
| 3. weeping willow tree _____ | |
| 4. raccoon _____ | 11. decaying logs and leaves _____ |
| 5. heat _____ | |
| 6. water _____ | 12. insects _____ |
| 7. sunfish _____ | 13. bird _____ |
| 8. water plants _____ | 14. bacteria, algae, and other one-celled organisms (not shown, but always present in a lake ecosystem) _____ |
| 15. Why are the one-celled organisms not shown? _____ | |

II. Now, answer these questions about ecosystems. Circle the correct answers.

1. An ecosystem is made up of (only living things, only nonliving things, both living and nonliving things).
2. All the living members of an ecosystem make up (a community, a species, the biosphere).
3. The region of Earth where life exists is called the (area, biosphere, population).
4. All of the living and nonliving parts of an organism's surroundings are called its (environment, ecology, population).
5. Living things (do, do not) affect other living things.
6. Do living things affect nonliving things? (yes, no)
7. Do nonliving things affect living things? (yes, no)
8. A change in one part of an environment (can, cannot) cause a change in another part of the environment.
9. The study of the relationship between organisms and their environment is called (an ecosystem, a habitat, ecology).
10. Changes in the environment (rarely happen, happen all the time, are always harmful).

III. An aquarium is an ecosystem you may have in your home.



A balanced aquarium is a healthy ecosystem. It is one in which all the organisms receive all the things they need to live. The wastes of one life form supply the needs for other life forms.

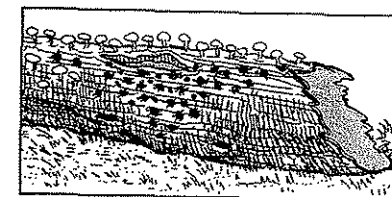
Answer these questions about the aquarium shown in Figure B.

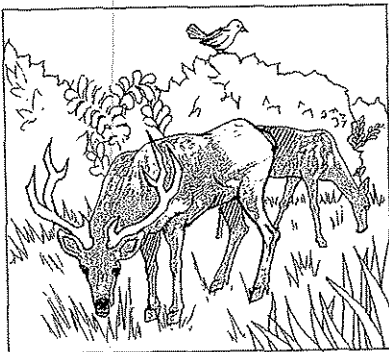
1. Fish can live only in _____.
2. a) What gas do plants give off as waste? _____
b) This gas is taken in by the _____.
3. Plants make their own food by photosynthesis. Carbon dioxide is needed for photosynthesis to take place.
a) Which organisms give off carbon dioxide as waste? _____
b) This gas is taken in by the _____.
4. Fish give off solid mineral wastes. These wastes are taken in by the _____.
5. Photosynthesis requires light. What supplies this light in an aquarium? _____.
6. Aquarium water must not become too cold. What maintains a proper temperature? _____.
7. There is one vital need of this ecosystem that you must add. What is it? _____.
8. Once in a while, you must add something else.
a) What is it? _____
b) Why must it be added? _____.

ABOUT HABITATS

A habitat is a special place. It provides all of an organism's needs, like food and air. It provides an organism with shelter. It also provides a place to reproduce. Sometimes, different species share the same habitat.

For example, insects and mushrooms may share the same rotting log.





Some birds may live with deer among shrubs. Or, you might find birds, squirrels, and insects living in the same tree.

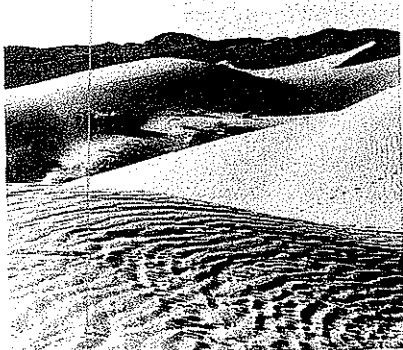
BIOMES

The biosphere is divided into major areas called biomes [BI ohms]. A biome is determined mainly by its climate—like temperature and rainfall. Climate, in turn, affects the soil and the kinds of plants and animals that live in an area.

A biome has no definite borders. One biome often blends into another.

There are water biomes and land biomes. We will study only land biomes.

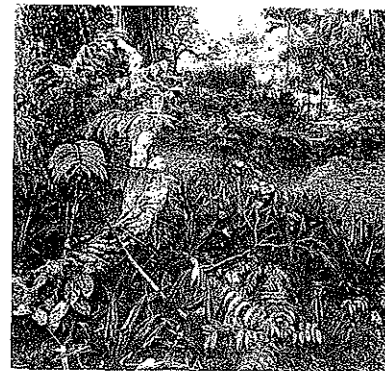
The photographs show the five major land biomes. Each biome is described below. Read each description. Then, write the name of the correct biome on the line below each photograph.



1. This photograph shows a _____ biome.



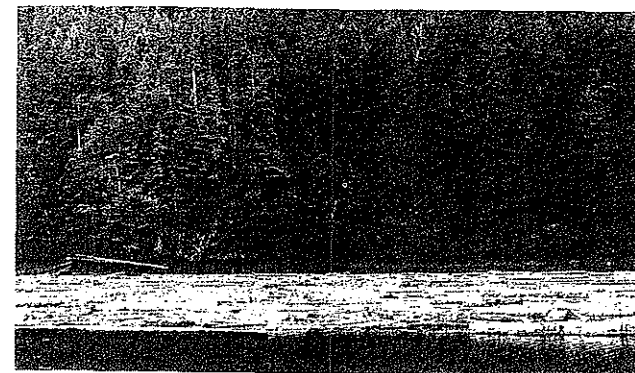
2. This photograph shows a _____ biome.



3. This photograph shows a _____ biome.



4. This photograph shows a _____ biome.



5. This photograph shows a _____ biome.

TUNDRA. Most of the year, the tundra is bitterly cold. It is covered with snow and ice.

The tundra summer is very short. It lasts only about 60 days. Even then, temperatures do not rise above 20° C (68° F).

Tundra soil is poor and very thin. It freezes in the winter and thaws in the summer. But the ground below does not thaw. It remains permanently frozen. That is why it is called *permafrost*.

Only certain small plants can grow in the tundra. Some animals, like reindeer and foxes, move in during the growing season. But they move out again as the frigid weather approaches. Very few animals live year round in the tundra.

CONIFEROUS FOREST. Conifers are cone-bearing trees. Most conifers, like pines and fir trees, stay green all year. They do not shed their needle-shaped leaves.

The winter temperatures of some northern coniferous forests is very cold—as cold as in the tundra. Southern forests are warmer.

Conifers form dense forests. The tree tops block out much of the sunlight. Little light reaches the forest floor. Grasses and smaller trees cannot grow. Only some shrubs, ferns, and mosses thrive.

Coniferous forests are “home” for many animals, like squirrels, deer, mountain lions, and foxes. Birds and insects are plentiful, too.

DECIDUOUS FOREST. Deciduous trees shed their leaves in the fall. Deciduous forests thrive in moderate climates. Summers may be hot and winters may be cold. But temperatures do not get too hot or too cold for a very long time.

Deciduous forests receive a good supply of water. They form dense forests. A deciduous forest provides habitats for many kinds of animals.

DESERT. A desert biome is very dry. It receives very little rainfall. Deserts are very hot during the day. But they are cool—even cold—at night.

Desert soil is dry and very poor. Because of this, only a few special plants grow here.

Very few animals can survive in the desert. A few species of snakes, lizards, and birds live in the desert environment. These animals sleep in the shade during the day. They become active mostly at night, when it is cooler.

GRASSLAND. The chief plantlife in the grassland is, of course, grass. Grassland and deciduous forest temperatures are about the same. But grasslands do not receive as much rainfall. Trees need more rain than grass. Grasslands get enough rain to support grasses—but not trees.

Some grasslands receive more rainfall than others. Taller, more closely-packed grasses grow in areas of greater rainfall. Shorter, widely-spaced grasses grow in drier areas.

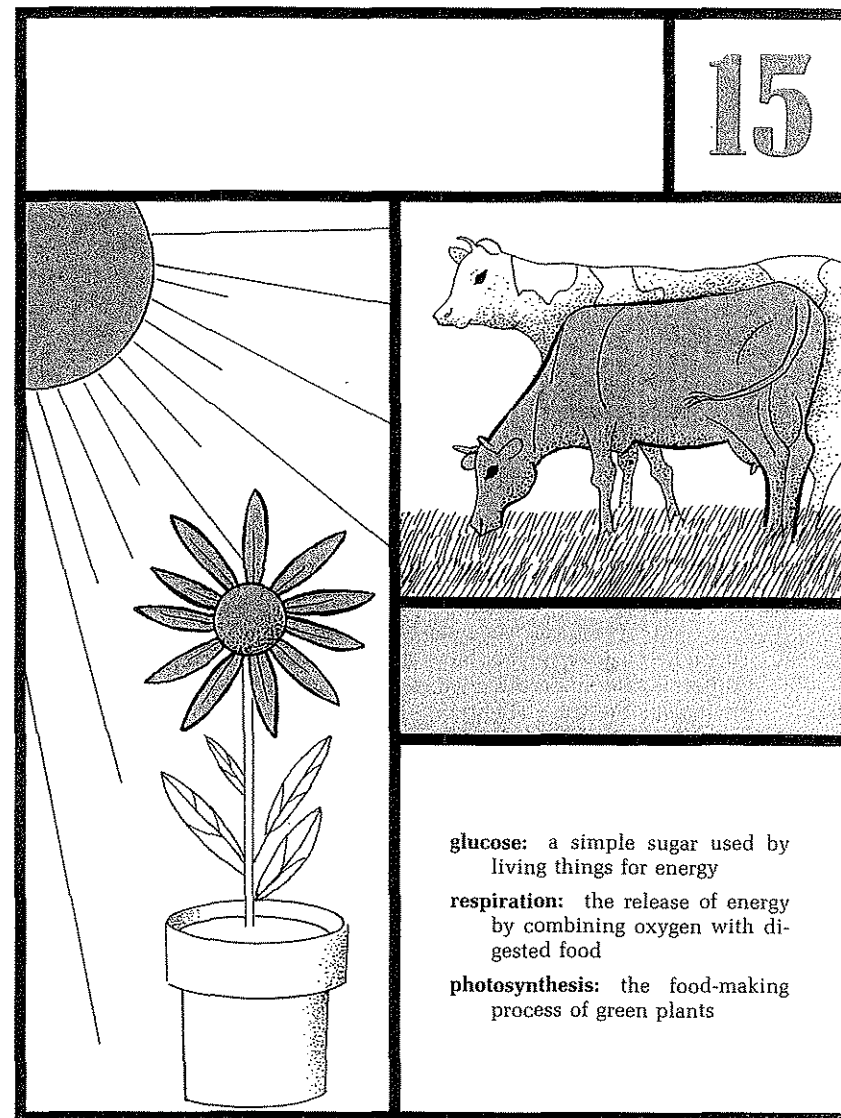
Grasslands are excellent for grazing animals. The soil of tall grass areas is very rich. Most tall grass areas in the United States are now used for farming. Wheat and corn is grown here. Grasslands are “home” for many small, burrowing animals.

RAIN FOREST. A tropical rain forest is very warm and very moist all the time. It receives plenty of sunlight and rain. In fact, it rains at least once each day. This environment is excellent for plant growth and soil development. Plants grow thick and tall. They often form jungles.

Rain forests support more plant life and animal species than any other biome.

HOW DO PLANTS AND ANIMALS GET THEIR ENERGY?

15



AIM | How do plants and animals 15 | get energy?

You need energy to live. So do birds, trees, and bacteria. All living things need energy to carry out the life functions. And, there can be no life without the life functions.

How do plants and animals get energy? The same way your car gets its energy—by burning a fuel. Cars use gasoline as a fuel. Energy is released when oxygen from the air combines with the gasoline in the engine.

Plants and animals use glucose as a fuel. Glucose is a simple sugar.

Oxygen links up with glucose in every cell. This link-up produces heat. Part of this heat is changed to the energy that is used for the life functions. This happens in every cell! The rest of the heat is given off as waste. This energy-producing process is called respiration.

WHERE DOES GLUCOSE COME FROM?

Animals ingest food. They eat plants or other animals. During digestion, some of this food is changed to glucose. Animals use this glucose for energy.

Plants are different. They make their own food in a process called photosynthesis [fo tuh SIN tuh sis].

Photosynthesis takes place in the leaves of green plants. The cells of green plants have structures called chloroplasts. Chloroplasts contain the green substance chlorophyll. Chlorophyll traps the sun's energy.

Carbon dioxide enters a plant through its leaves. Water enters through the roots. With the help of the sun's energy, the water and carbon dioxide link-up in the plant's leaves. This link-up produces the glucose the plant uses for food and energy. It also produces oxygen.

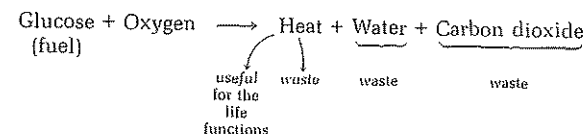
Some of the oxygen is used by the plant. The rest is given off in the air as waste. Animals breathe in this oxygen.

Photosynthesis is the key to all life. Without it, there would not be any plants. There would be no oxygen . . . or animals. In short . . . NO LIFE!

MORE ABOUT RESPIRATION AND PHOTOSYNTHESIS

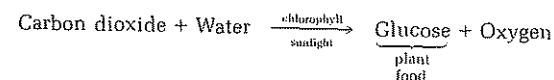
The energy-producing process in living things is called respiration. Respiration is the release of energy by combining oxygen with digested food (glucose).

Respiration can be shown in this way:



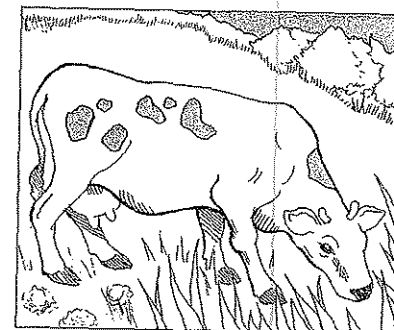
The food-making process of green plants is called photosynthesis. Photosynthesis is also responsible for the production of oxygen.

Photosynthesis can be shown in this way:



ENERGY CARRIES OUT THE LIFE FUNCTIONS

- I.
 1. a) What fuel do animals use for energy? _____
 - b) What must link up with this fuel to produce energy? _____
2. Energy is produced in every _____ of an animal.



II.

3. a) What fuel do plants use for energy? _____
b) What must link up with this fuel to produce energy? _____
4. Energy is produced in every _____ of a plant.

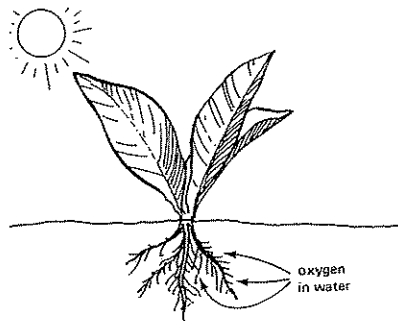


FIGURE B

III.

5. What do we call the release of energy by living things? _____
6. Respiration is _____ in plants and animals.
different, the same
7. Respiration produces three waste products. They are _____, and _____

IV.

Animals cannot make their own food. Animals take in food from the outside.

1. What foods do animals eat?



FIGURE C

2. What life function changes some food to glucose? _____

V.

3. Do plants take in food from the outside?

4. How do plants obtain food? _____

5. The food-making process of plants is called _____.
6. Photosynthesis chemically combines two products. Name them. _____ and _____
7. Photosynthesis also requires energy and the green substance called _____.
8. In which part of a plant does most photosynthesis take place? _____

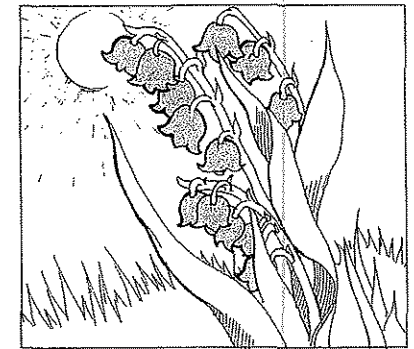


FIGURE D

VI. Study Figure E carefully. Then answer these questions.

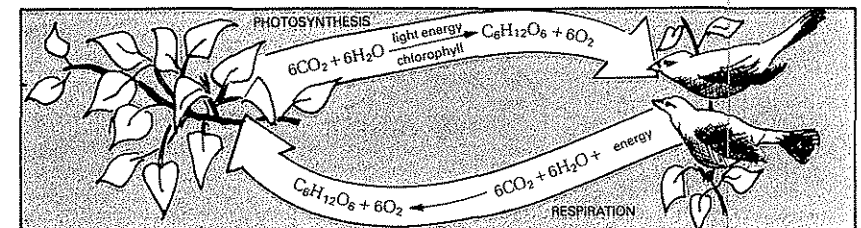


FIGURE E

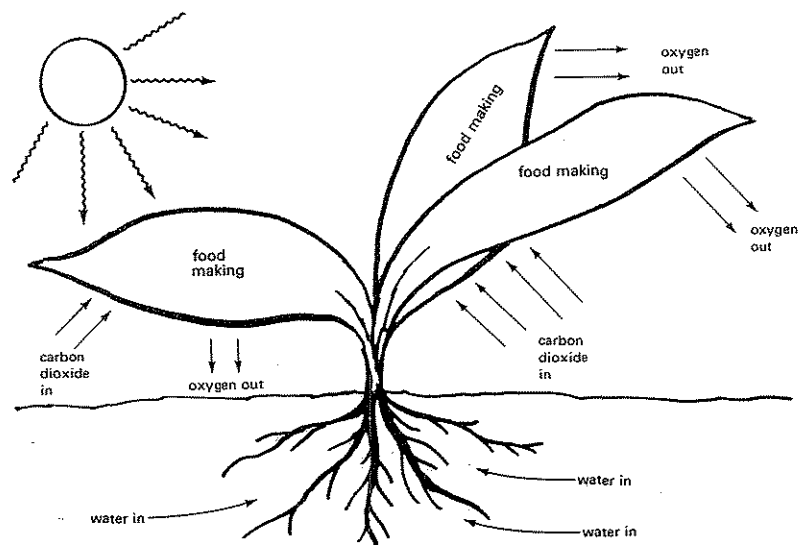
1. In photosynthesis,
 - a) what are the starting products? _____ and _____
 - b) what are the end products? _____ and _____
2. In respiration,
 - a) what are the starting products? _____ and _____
 - b) what are the end products? _____ and _____
3. Photosynthesis and respiration are _____
the same, opposite



ABOUT PHOTOSYNTHESIS

This picture shows photosynthesis taking place. Photosynthesis takes place in green plants only. When green plants are in sunlight, this is what happens:

water plus carbon dioxide **makes** plant food (glucose) and waste gas (oxygen).



Look at the picture and then answer the following questions about photosynthesis.

1. Does photosynthesis take place in the leaves or in the roots? _____
2. What two materials are needed for photosynthesis? _____
3. What else is needed for photosynthesis? _____
4. Where does the carbon dioxide gas come from? _____
5. What are the two things that photosynthesis makes? _____
6. What does a plant make as food? _____
7. What does a plant make as waste gas? _____
8. What living things use the waste gas? _____

FOOD—THE CHAIN OF LIFE

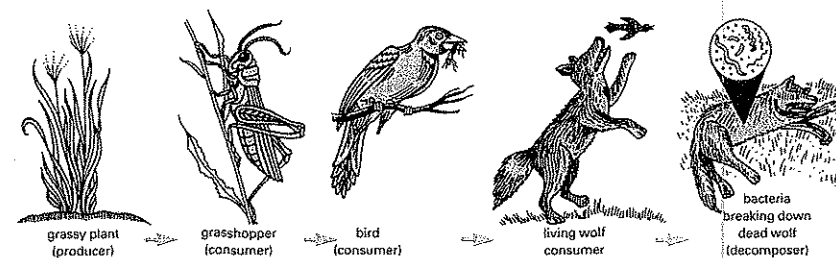
Living things depend upon each other for food. Every living thing is a link in a *food chain*. A food chain lists the order in which living things feed upon other living things.

Not all organisms eat the same kind of food. Therefore, there are many different food chains. But all food chains begin with plants.

All food can be traced back to green plants and, of course, the sun. Green plants are called *producers*. All other organisms in a food chain are called *consumers*. Consumers eat green plants either directly or indirectly. For example, a sheep consumes plants *directly*. A lion, on the other hand, eats meat. It consumes plants *indirectly*.

A food chain ends with *decomposers*. Decomposers are organisms that break down dead plants and animals. The decomposed organism becomes mostly minerals and water. These minerals enrich the soil and help plants grow.

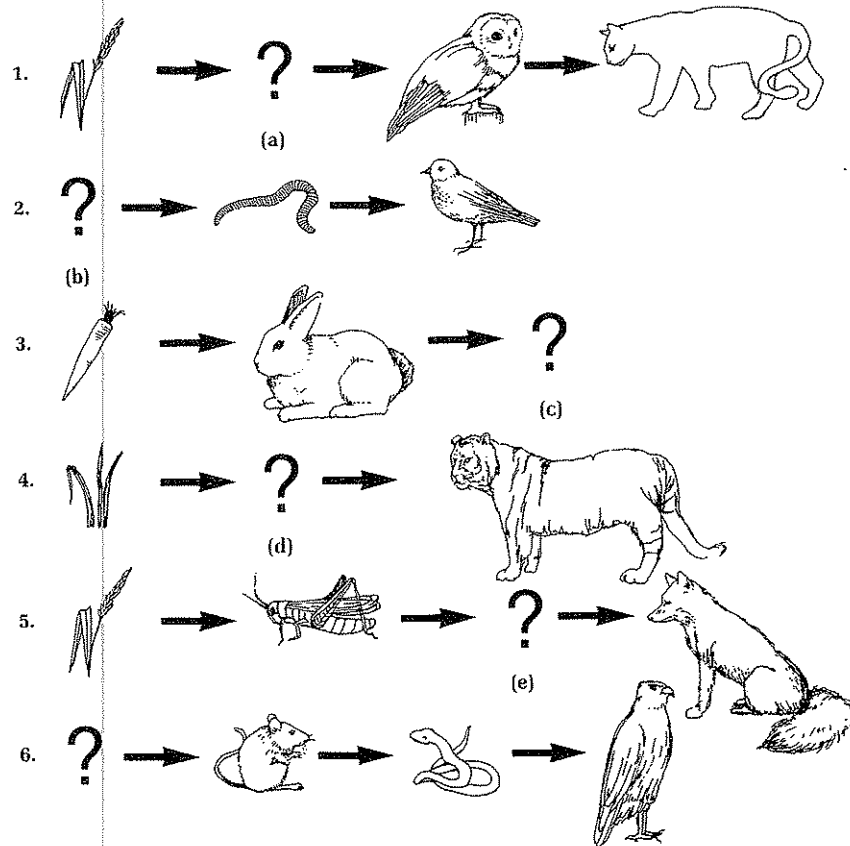
This is an example of a food chain:



In this food chain, the grasshopper eats the plant; the bird eats the grasshopper; and the wolf eats the bird. Finally, the wolf dies. Bacteria of decay (decomposers) break down the dead wolf.

FINDING THE MISSING LINKS IN FOOD CHAINS

Eight food chains are shown below. One link has been left out of each chain. Identify the organism that is missing. Write your answers in the proper spaces below. (Note that the decomposers have been left out of each chain. Do not list them.) Some blank spaces may have more than one answer.



1 a. _____

2 b. _____

3 c. _____

4 d. _____

126

5 e. _____

6 f. _____

COMPLETING SENTENCES

Complete the sentences with the words below. Five words will be used twice.

chlorophyll
glucose
respiration

life functions
carbon dioxide
light

photosynthesis
oxygen
water

- The release of energy in living things is called _____.
- Respiration links up the simple sugar, _____, with the gas, _____.
- Respiration releases useful and waste energy. Also given off as waste are _____ and _____.
- The energy released during respiration is used for the _____.
- The food-making process of plants is called _____.
- The products that chemically link up during photosynthesis are _____ and _____.
- The substance in the leaves of green plants that is needed for photosynthesis is _____.
- Photosynthesis also requires _____ energy.
- The waste gas of photosynthesis that is used by both plants and animals is _____.
- a) Carbon dioxide + water $\xrightarrow[\text{chlorophyll}]{\text{sunlight}}$ glucose + oxygen

This equation tells the story of _____.

b) Glucose + oxygen $\longrightarrow$ heat + water + carbon dioxide

This equation tells the story of _____.

REACHING OUT RESEARCH

I. A plant makes its own food (glucose). Plants also make other nutrients. These nutrients are made of glucose, water, and minerals.

1. Name some of the other nutrients a plant makes. _____
2. How does a plant get minerals? _____

II. Algae have chlorophyll and carry out photosynthesis.

1. How do algae get their food? (Hint: You can look back to Aim 12 if you need help.) _____

2. How do the other protists get their food?

PROTOZOANS _____

SLIME MOLDS _____

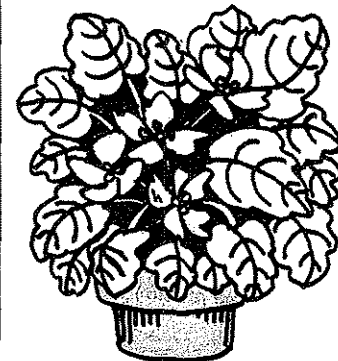
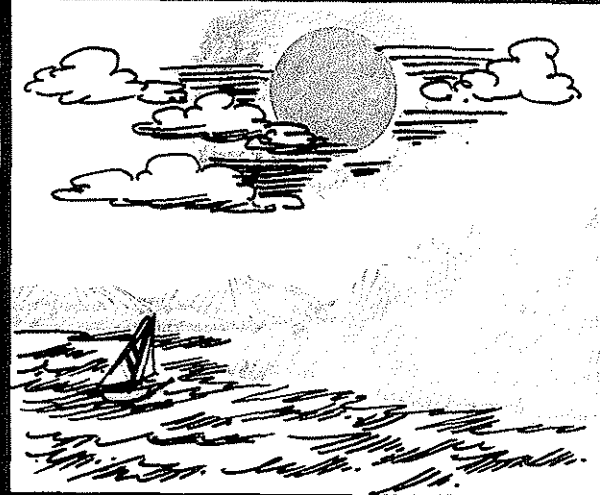
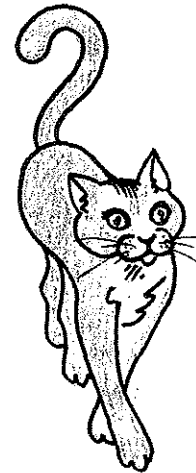
FUNGI _____

BACTERIA _____

VIRUSES (Careful, this one is tricky!) _____

WHAT DO LIVING THINGS NEED TO STAY ALIVE?

16



environment: everything that surrounds an organism

AIM | What do living things need to 16 stay alive?

Imagine that you are chosen to go to the moon. What must you take along? Food and water? Yes, of course. But is that all?

There is no oxygen in space. Where the sun shines, it is very, very hot. Where there is no sunlight, it is unbearably cold. On the moon, you would have to wear a space-suit to protect you from the temperature extremes. You would also need an oxygen supply.

What must you take along on a trip to the moon? In short—**YOUR OWN ENVIRONMENT.**

As you know, living things are in constant contact with their environment. On Earth, the environment provides organisms with all the things they need to stay alive. For example, all living things need *food*, *oxygen*, *water*, and a *proper temperature*. Plants also need *carbon dioxide*. But how is each of these things important?

FOOD Food provides organisms with the energy for life. It also provides organisms with the materials needed for growth and repair.

Animals take in their food from the outside by eating plants or other animals. Plants, as you know, make their own food through the process of photosynthesis.

OXYGEN Oxygen is used by most living things for respiration. During respiration, oxygen links up with digested food. This link-up produces energy.

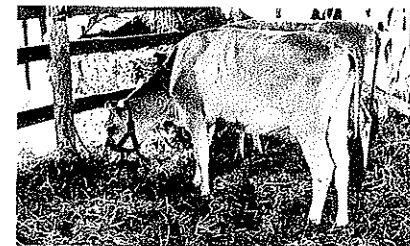
Land organisms get most of their oxygen from the air. Organisms that live in the water take in oxygen that is dissolved in the water.

WATER All living things are made mostly of water. In fact, between 65 percent and 95 percent of an organism's body may be made up of water. The materials needed for the life functions are dissolved in this water.

PROPER TEMPERATURE Organisms live in many different climates. Some organisms live in hot climates. Others live in cold climates. There can be no life if temperatures are too hot or too cold.

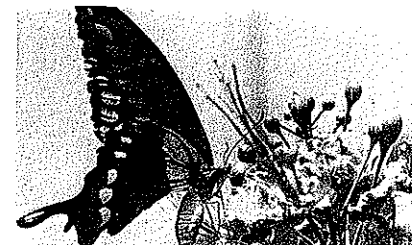
WHAT DO THE PICTURES SHOW?

Look at the pictures. Then answer the questions.



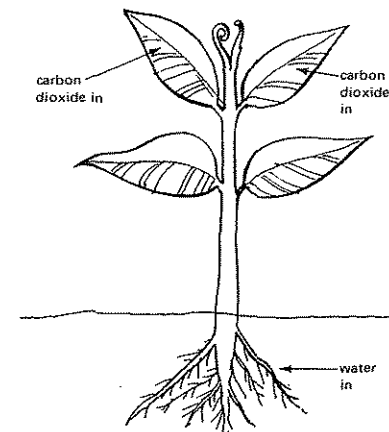
1. How do animals ingest their food?

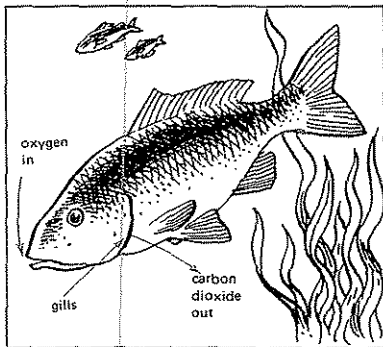
2. Do all animals eat the same kind of food? _____



3. Do plants take in food from the outside? _____

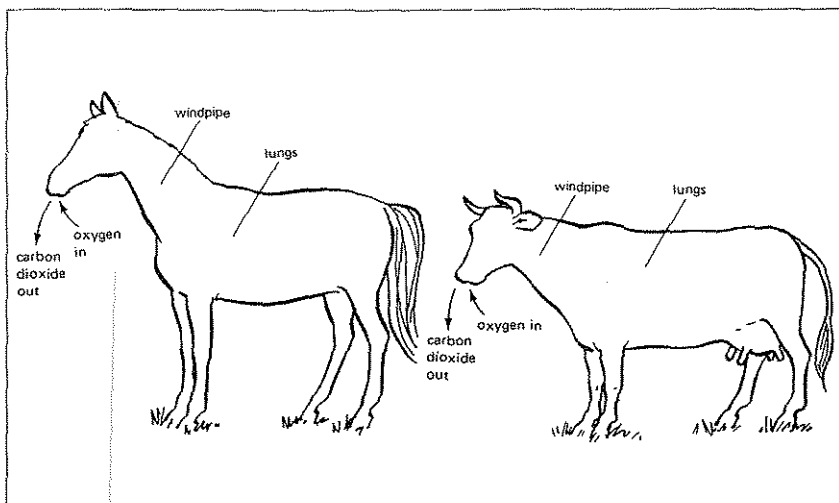
4. Where do plants get their food?





5. The oxygen that fish breathe in is dissolved in the _____.
6. Fish take in oxygen through _____
gills, lungs

7. During respiration, fish give off _____ as waste.
oxygen, carbon dioxide
8. Plants in the water use the _____ given off by the fish for photosynthesis.
oxygen, carbon dioxide



9. The oxygen that land animals breathe in is part of the _____.
10. Land animals take in oxygen through _____
gills, lungs

11. Why must all living things have water? _____
12. How do most animals ingest water? _____



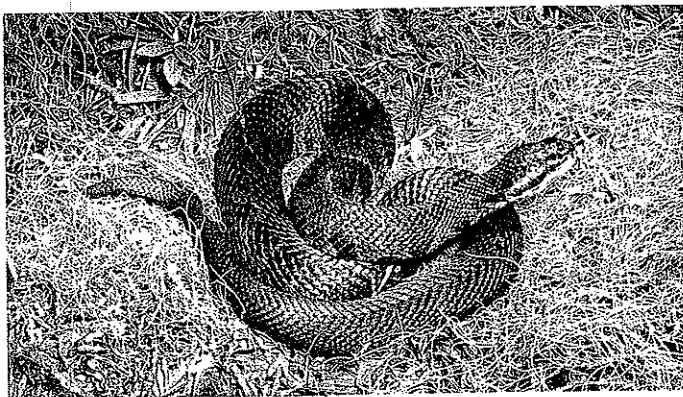
13. What part of a plant takes in water? _____
14. How do plants get their food? _____
15. Plants take in oxygen in three ways
- a) some oxygen from the air enters a plant through its leaves
 - b) plants make some of their oxygen during photosynthesis
- What is the third way a plant gets oxygen? _____
16. Why do many desert plants have roots that reach deep into the ground? _____

WARM- BLOODED AND COLD- BLOODED ANIMALS

In Aim 13, you learned that some animals are warm-blooded. Other animals are cold-blooded. Use what you learned in Aim 13 to answer the questions below. (You may look back to pages 103 and 104 if you need help.)

1. The body temperature of a cold-blooded animal _____ when the temperature of its surroundings change.
changes, stays the same
2. The body temperature of a warm-blooded animal _____ when the temperature of its surroundings change.
changes, stays the same
3. Fish, amphibians, and reptiles are _____ animals.
warm-blooded, cold-blooded
4. Birds and mammals are _____ animals.
warm-blooded, cold-blooded
5. What do birds have covering their bodies to help keep them warm?

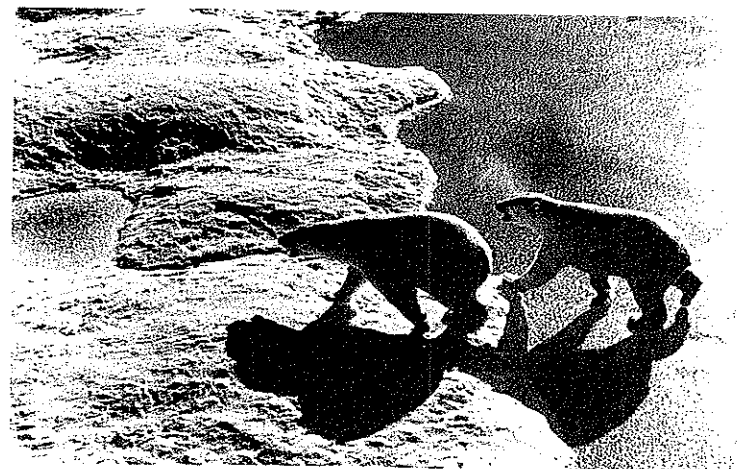
6. What do mammals have covering their bodies to help keep them warm?



7. Why do snakes stay in the shade during the hottest part of a summer day? _____

We get most of what we need from our natural environment. Sometimes we must give our natural environment a "little help". For example, in very cold weather we heat our homes and wear warm clothing. In very warm weather, we wear lighter clothing.

8. Why should you wear several layers of clothing in the winter? _____



9. Why do some animals have thick coats of fur? _____
10. Why are there no large plants at the north or south poles? _____

COMPLETING SENTENCES

Complete the sentences with the words below. Three words are used twice. One word is used three times.

proper temperature	environment	water
roots	gills	oxygen
carbon dioxide	air	photosynthesis
lungs	food	outside

1. Everything that surrounds an organism is called its _____.
2. The things that living things need to stay alive are _____, _____, and _____.
3. Living things get what they need from the _____.
4. Plants need food, oxygen, water, and a proper temperature. Plants also need _____.
5. Living things are made mostly of _____.
6. Water is taken in by a plant through its _____.
7. Oxygen is taken in by plants in three ways.
 - a) Some oxygen from the _____ is taken in through the leaves.
 - b) Plants make some of their oxygen during _____.
 - c) Some oxygen is taken in from the _____ a plant takes in through its roots.
8. Land animals take in oxygen through _____. Fish take in oxygen that is dissolved in the water through _____.
9. During respiration, oxygen combines with digested _____ to produce energy.
10. Plants make their own food during _____. Animals take in their food from the _____.

MATCHING

Match the two lists. Write the correct letter on the line next to each number.

- | | |
|---|--|
| 1. _____ carbon dioxide | a) gas needed by plants |
| 2. _____ food oxygen, water, and proper temperature | b) needed by all living things |
| 3. _____ green plants | c) two substances needed for respiration |
| 4. _____ oxygen and food | d) make their own food |
| 5. _____ animals and most protists | e) take in their food from the outside |

TRUE OR FALSE

Write T on the line next to the number if the sentence is true. Write F if the sentence is false.

1. _____ Living things are affected by the environment.
2. _____ The environment is always the same.
3. _____ Living things can live in any temperature.
4. _____ Clothing helps us keep warm when the temperature changes.
5. _____ Every living thing needs oxygen.
6. _____ Living things need only oxygen.
7. _____ Plants take in food from the soil.
8. _____ Energy comes from food.
9. _____ Carbon dioxide links up with digested food to release energy.
10. _____ Plants take in oxygen through lungs.

REACHING OUT Some animals eat only plants. Some animals eat only meat. Some animals eat both plants and meat.

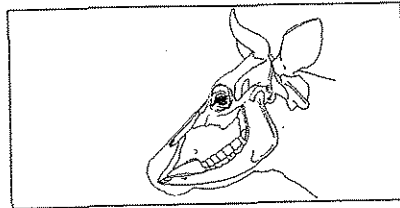
Look at the lion's teeth. How are such teeth suited to the kind of food they eat?

What kind of food do lions eat? _____



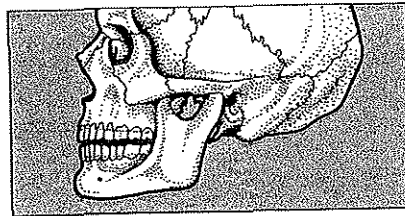
Cows and sheep have flat teeth like these. How are such teeth suited to the kind of food they eat? _____

What kind of food do they eat? _____



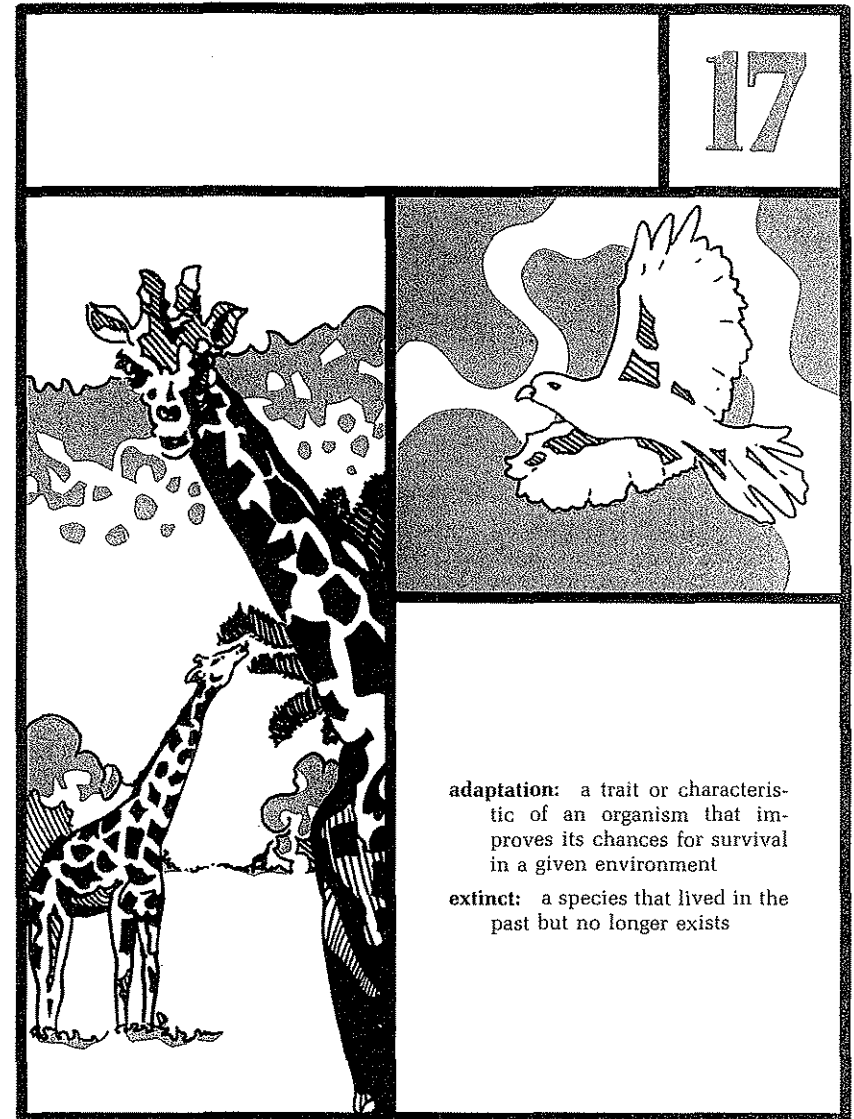
These are human teeth. How are our teeth suited to the kind of food we eat? _____

What kind of food do we eat? _____



WHAT IS ADAPTATION?

17



adaptation: a trait or characteristic of an organism that improves its chances for survival in a given environment

extinct: a species that lived in the past but no longer exists

AIM | What is adaptation?

17

Polar bears live unprotected in sub-zero weather. You cannot. Neither can most organisms.

Polar bears are "built" for the bitter cold. They have a thick layer of fat and dense fur.

Some animals live comfortably in other climates. The camel, for example, is suited to live in the hot, dry desert. Alligators are suited to live in hot, humid marshes.

An organism must be well suited to its environment in order to survive. It must be able to tolerate the climate. It must also be able to get food, protect itself from enemies, and reproduce. An organism that is well suited to its environment is said to be adapted [uh DAPT ud] to its environment.

Earth is about 4 1/2 billion years old. Life has existed here for more than one billion years. Fossil records tell us that Earth has been constantly changing. So have its life forms.

Many species that lived in the past have died out. They are extinct [ik STINGKT]. These organisms could not adapt to their changing environments.

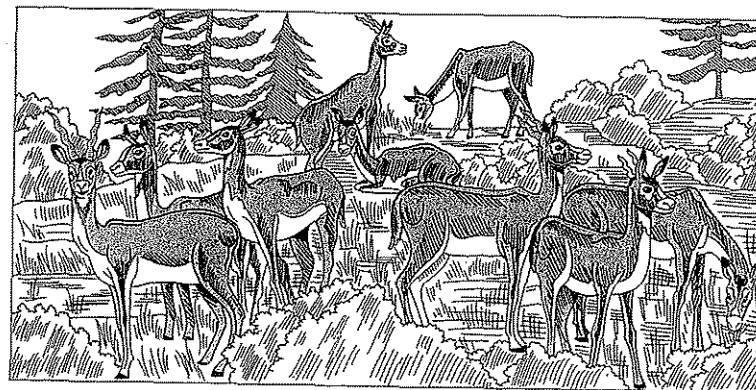
Adaptation does not only apply to animals. It applies to plants and protists as well. For example, a cactus can grow in the hot, dry desert. An oak tree, on the other hand, grows well in a cooler, moister environment.

How does adaptation take place? There are many theories. The most accepted one is Darwin's Theory of Natural Selection (1859). This theory is explained on the next page.

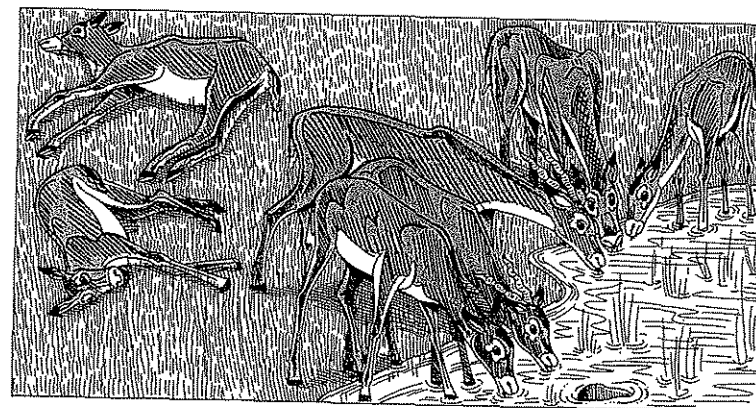
DARWIN'S THEORY OF NATURAL SELECTION

I. According to Darwin's theory:

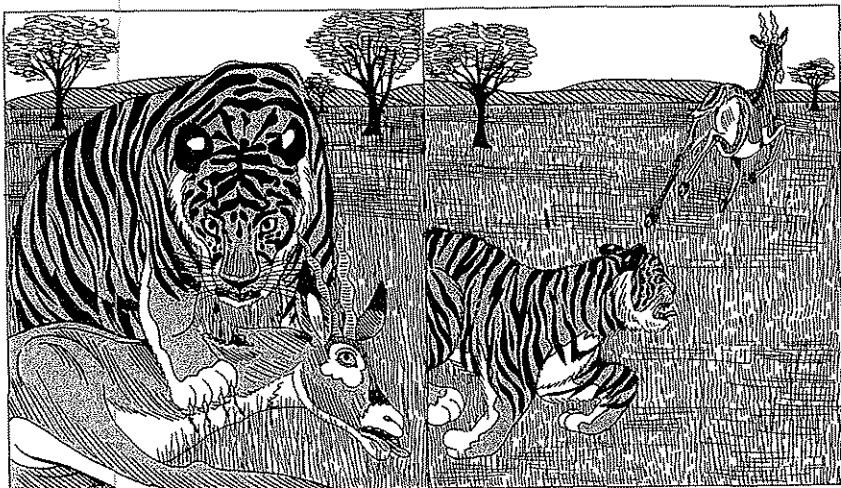
1. Organisms produce more offspring than the environment can support. Some must die to allow a proper balance of life to continue. Which ones will die?



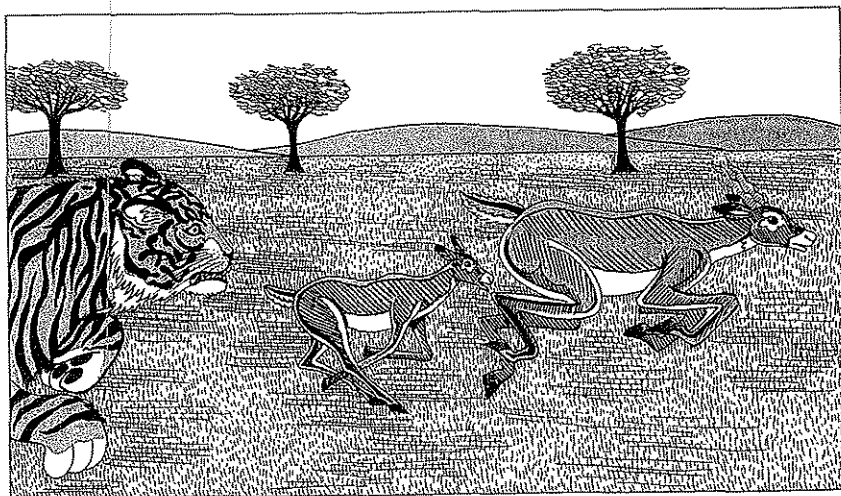
2. Overproduction leads to a struggle. All the organisms compete for food, water, and the other necessities of life. Only those organisms that are well suited to their surroundings survive. The rest die.



3. Organisms of the same species are very similar. But they do have individual differences. These differences are important in the "struggle for survival." For example, extra speed can mean the difference between life and death. A fast antelope may escape an attacking tiger. A slower neighbor may become the tiger's next meal.



4. The most adapted organisms survive and reproduce. They, in turn, pass their favorable traits to their offspring. The offspring are then more likely to survive.



UNDERSTANDING THE THEORY OF NATURAL SELECTION

II. Study the diagrams. Then, answer the questions.

1. According to Darwin, did all ancient giraffes have long necks?

2. _____ -necked giraffes
Long, Short
were better able to reach food far off the ground.

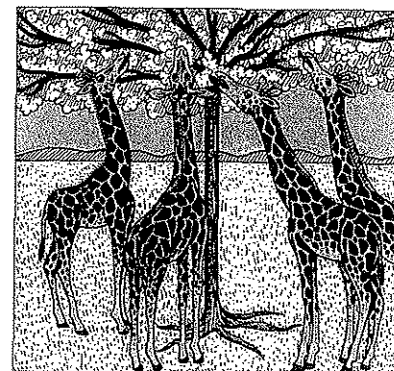
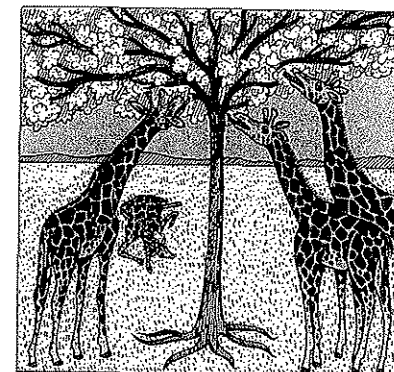
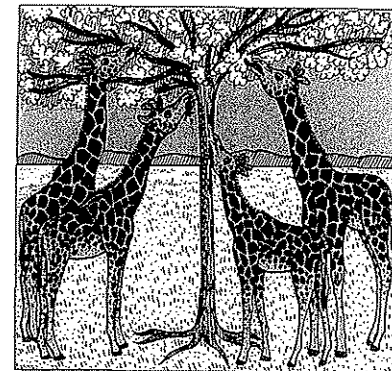
3. _____ -necked giraffes
Long, Short
were better suited to the environment.

4. The _____ -necked giraffes died out.
long, short

5. Which giraffes survived and reproduced?

- a) The _____ -necked giraffes.
long, short
- b) What important adaptation did the surviving giraffes pass on to their offspring?

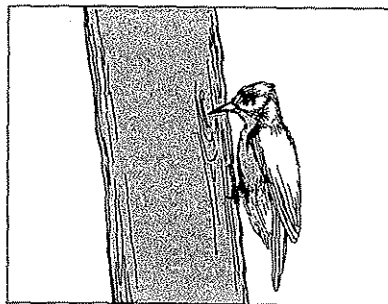
6. Describe the necks of all giraffes living today (HINT: One word will do)



MORE ABOUT ADAPTATION

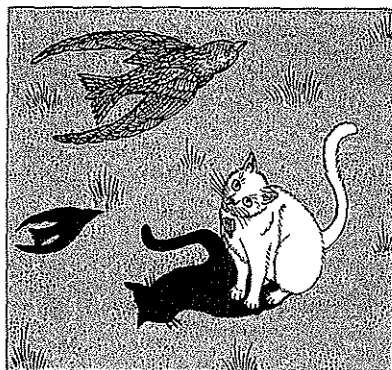
III. Adaptation may take many forms. These are a few examples.

The woodpecker is well adapted to dig insects out of trees.

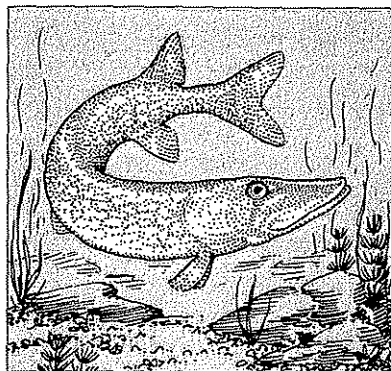


Birds have feathers and lightweight bones. They are well adapted for flight.

Can you think of a better way to escape an attacker? Fly away and live to fly another day.

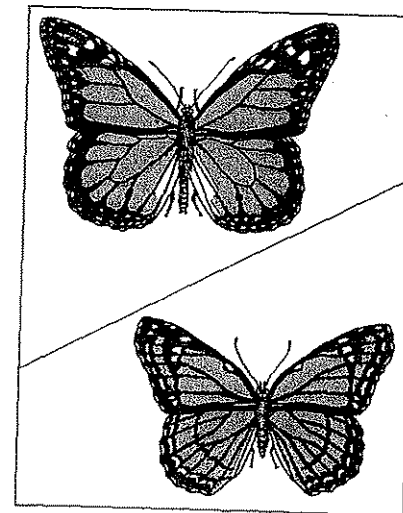


The streamline shape of fish allow them to move quickly through the water.



Some organisms adapt by looking like other organisms. For example, the monarch butterfly (top) is "bad tasting."

The viceroy butterfly (bottom) is not bad tasting. Hunting birds do not know this. They are fooled by the look-alike butterfly. So they stay away from both species.



Some organisms blend in with their surroundings. This makes it difficult for other organisms to see them . . .

See how this toad blends in with its surroundings. It is almost invisible.

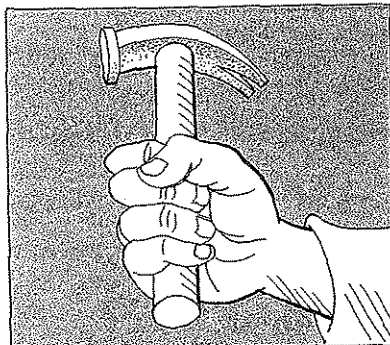


The polar bear and the snowy owl blend in with the white arctic snow.



HUMAN ADAPTATION

An important human adaptation is the thumb. How important is the thumb? More important than you may realize. . .



Try this:

Tape your right thumb (if you are right-handed) to your next finger. Then try to do these tasks. . . .

1. Fasten (or unfasten) a button.
2. Pick up a book.
3. Turn a doorknob.
4. Hold an object as you would a hammer.
5. Turn a screwdriver.

How important is the thumb? You answer the question!

Do you think civilization would be as advanced if people did not have thumbs?

Explain your answer. _____

COMPLETING SENTENCES

Complete the sentences with the words below.

changing
Charles Darwin
shape up
limited number

favorable
adapted
help
not survive

organisms
ship out
very different
reproduce

1. An organism that is suited to its environment is said to be _____ to its surroundings.
2. Earth is always _____.
3. As the earth changes, the _____ that live on it also change.
4. An organism that does not change as its environment changes may _____.
5. The scientist who developed an important theory about adaptation was _____.

ACCORDING TO DARWIN:

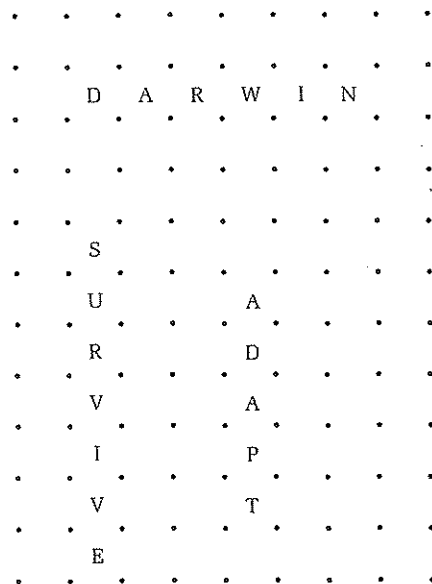
6. A favorable environment can support only a _____ of organisms.
7. Organisms belonging to the same species can be _____.
8. Some individual differences _____ an organism survive.
9. Organisms that adapt to their environment may _____ and pass their _____ traits on to their offspring.
10. Using Navy terms, Darwin said that as far as adaptation is concerned, "you either _____ or _____."

CONNECTING DOTS Each player draws a line. If the line completes a box then the player goes again. Put your initials in the boxes you complete.

Scoring:
empty box counts 1 point
box with a letter counts 2 points
add 10 points for each complete word

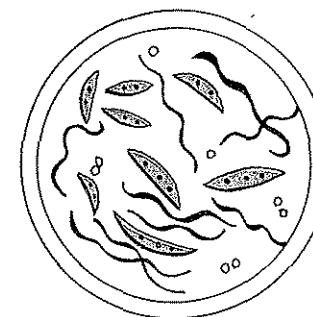
SCORE

Name _____ Name _____



WHAT ARE INFECTIOUS DISEASES?

18



disease: any condition that interferes with the normal functions of an organism

infectious disease: a disease caused by a germ that can be passed from one organism to another

toxin: a poison

AIM | What are infectious diseases?

18

Disease is a great enemy of living things. A disease interferes with the normal functions of an organism.

Diseases injure or kill millions of people each year. Diseases also infect plants and animals. They destroy crops. They kill cattle, poultry, and other animals.

Many human diseases cannot spread to others. These diseases are not contagious (catching). They include heart disease, and those diseases caused by allergies, poor diet, and the environment.

Some diseases are contagious. These diseases are called infectious [in FEK shus] diseases. They can be spread from person to person. Many can spread among plants and animals. Contagious diseases are caused by bacteria, viruses, and other microbes.

Let's look at how disease symptoms develop. Microbes attack living tissue. . . .

- Some microbes live in the tissue. They multiply so fast that the tissue dies.

- Other microbes produce poisons called toxins. These toxins kill the tissue.

Our bodies fight disease in many ways. Our skin helps to keep microbes from getting into our bodies. Tears wash germs away from the eyes. Mucus, a sticky liquid, and tiny hairs in the nose and windpipe trap germs. Even the liver and saliva kill certain kinds of germs.

Perhaps the most important germ-fighters are white blood cells. They seek out and destroy disease-causing germs.

Sometimes, our body's natural defenses are not enough. We develop a disease. Then, we must be treated by a doctor. Antibiotics, like penicillin and the sulfa drugs, are important disease-fighting drugs.

A word of caution. . . . Never treat yourself when you are ill. See your doctor.

PREVENTING DISEASES

The discovery of disease-fighting medicines has been very important in treating disease. But the best way to treat disease is to prevent it.

- Nutritional diseases can be prevented by eating properly.

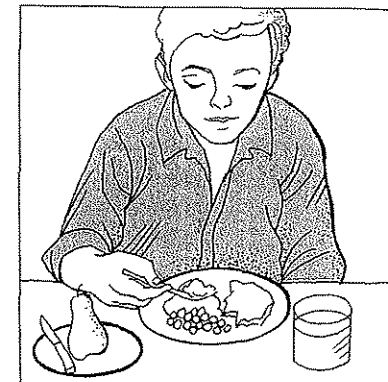


Figure A

- Many diseases can be prevented by proper sanitation.



Figure B

- Proper canning, pasteurization [PAS chuh ruh ZAY shun], and refrigeration help prevent many diseases.

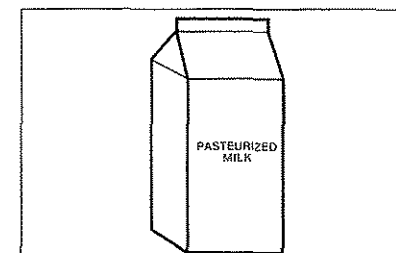


Figure C

□ Vaccinations are helpful in preventing specific diseases like polio and the measles. A vaccine is made of specific dead or weakened disease-causing microbes.



Figure D

How does a vaccine work? The vaccine enters the body by injection, through a scratch, or by swallowing. A vaccine signals the body to make antibodies. Antibodies are germ-fighting chemicals. They are made by the white blood cells. Antibodies destroy disease-causing microbes.

A vaccinated individual becomes *immune*, or resistant to, a specific disease. But a “booster” shot may be required, after a period of time, to keep the immunity.

Having had a certain disease also signals the body to produce antibodies. Immunity of this kind does not usually require a “booster.”

THE SEARCH GOES ON. . . .

The search to develop new vaccines never stops. Special effort is being made to develop vaccines against cancer and AIDS.

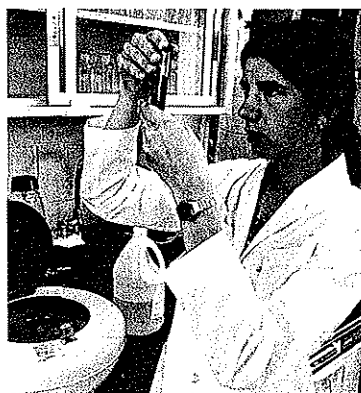


Figure E

ANIMAL DISEASES

Farm animals like cattle, hogs, and sheep, are called *livestock*.

Animal diseases kill more than two billion dollars worth of livestock each year—in the United States alone.

One of the worst livestock diseases is hoof-and-mouth disease. It is caused by a virus and it spreads very rapidly. Many of the infected animals die.

A farmer may have to kill all the animals that are near an infected animal to prevent an epidemic. An epidemic is the spread of a disease to many organisms at the same time.



Figure F

PLANT DISEASES

At one time, the most important food crop in Ireland was the potato.

During the 1840's, a fungus disease destroyed the potato crop in Ireland. Between 1845 and 1847, nearly 750,000 people died of starvation. Hundreds of thousands of others fled the country in search of food and a new life. Many of these people came to the United States.



Figure G

SOME COMMON INFECTIOUS DISEASES OF HUMANS

The chart below lists several infectious diseases of humans. Study the chart. Then answer the questions on page 155.

DISEASE	SYMPTOMS	PREVENTION
Chicken pox	Fever, headache, skin rashes that form crusts	None, but attack gives permanent immunity
German measles	Rash, sore throat, headache, cough, swollen glands	None but attack gives permanent immunity
Measles	Fever, rash, sensitivity to light, cough, body aches	Measles vaccine
Influenza (in floo EN zuh) (Flu)	Fever, chills, body aches, (and possibly a sore throat and cough)	Vaccine that gives limited protection for a few months
Mumps	Fever, chills, headache, swollen neck and throat glands	Vaccine available (but cannot be given to people with some types of allergies)
Polio	Fever, sore throat, stiff back, muscle pain, paralysis	Polio vaccine
Scarlet fever	High fever, chills, rash, sore throat	None, but attack gives permanent immunity
Smallpox	Fever, chills, headache, rash that leaves scabs	Smallpox vaccine during the first year of life. Booster shots every 5 to 7 years. Attack gives permanent immunity
Whooping cough	Hacking cough, fever, vomiting, increased nose and throat mucous	Whooping cough vaccine at 3 months of age, then repeated vaccines during pre-school years. Attack usually gives permanent immunity.

1. How many of these common diseases have you had? _____
2. Which diseases have you had? _____
3. Which of these diseases have you been vaccinated against?



The mumps is an infection of the salivary glands. Did you ever have the mumps?

At one time many children had the mumps. Now fewer children have this infection. They have been inoculated against it.

Figure H

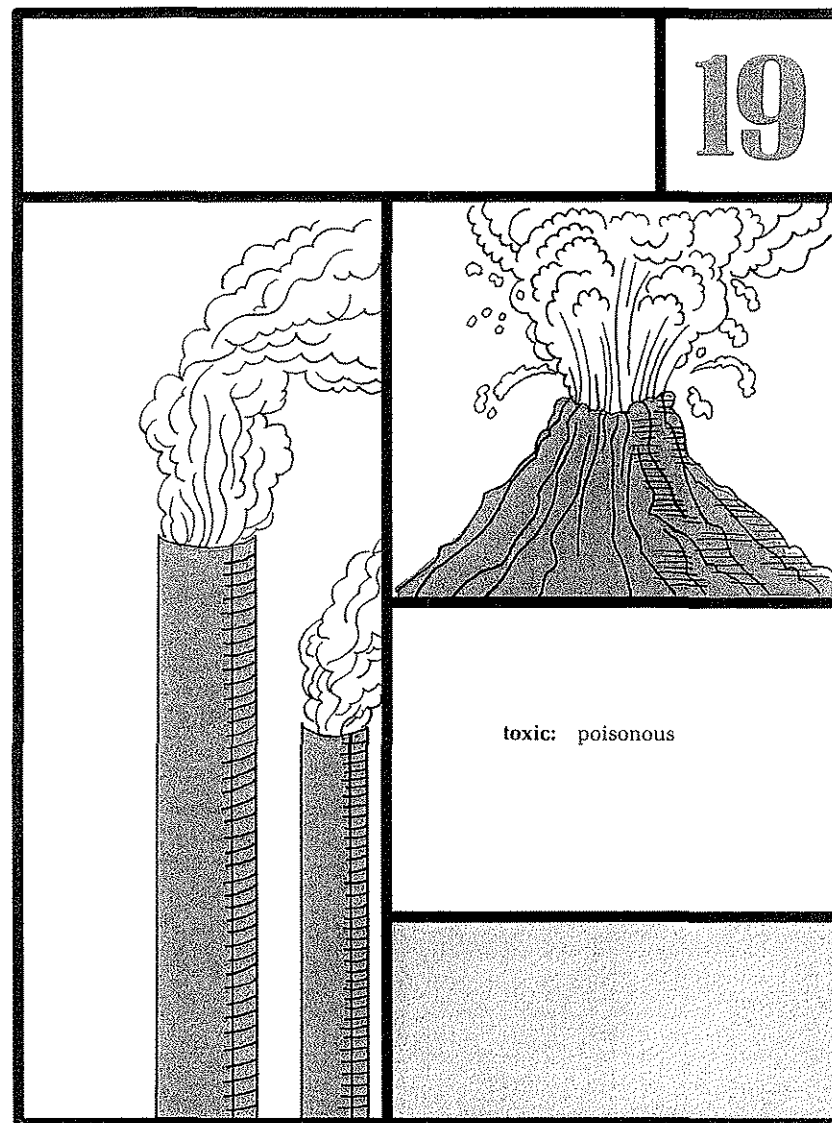
COMPLETING SENTENCES Complete the sentences with the words below.

mucus	disease	cannot
toxins	the skin	tears
the environment	reproducing	sulfa drugs
vaccinated	antibodies	microbes
penicillin	the liver	dead
poor diet	tiny hairs	white blood cells
allergies	weakened	saliva

1. The breakdown of the normal workings of an organism is called a _____.
2. A disease that is not contagious _____ be spread to another organism.
3. Some causes of non-contagious diseases are _____, _____, and _____.
4. Contagious diseases are caused by _____.
5. Microbes cause disease symptoms by rapidly _____ in living tissue or by producing poisons called _____.
6. Some of our body's natural defenses against diseases include _____ in the nose and windpipe, _____, _____, and _____.
7. Two important disease-fighting medicines are _____ and the _____.
8. Getting _____ is one way to prevent a specific microbe-caused disease.
9. A vaccine is made up of _____ or _____ disease-causing microbes.
10. A vaccine causes the body to produce disease-fighting chemicals called _____.

WHAT THINGS CAN CHANGE THE ENVIRONMENT?

19



AIM | What things can change the 19 environment?

One of the world's greatest disasters took place on August 27, 1883. A volcano on the island of Krakatoa exploded. Much of the island was blown to bits. One part that stood almost a kilometer (one-half mile) high, was left covered by nearly 275 meters (900 feet) of water.

The explosion caused a huge tidal wave. It swept over nearby islands. More than 36,000 people drowned.

The Krakatoa disaster caused great changes in the environment. Volcanic dust soared high into the atmosphere. Much of the sun's energy was blocked. Winds carried this dust around the world for more than a year. Temperatures dropped. Crops did not grow well. Animals were confused. They could not tell day from night.

Earth's history is a history of change. Some changes, like the Krakatoa volcano, earthquakes, lightning-caused fires, severe storms, floods, and droughts, are *natural* events. These changes upset nature's balance. Habitats are destroyed. Plants and animals die.

If left alone, nature will repair much of its own damage. But, it may take years for the environment to recover.

People upset nature's balance also. Forests and jungles are destroyed for mining, lumbering, and industry. Farmland is replaced with new roads, shopping centers, and housing developments.

People disturb the environment in other ways, too. We pollute the air, land, and water. We burn fuels that give off dust, soot, and chemicals. Harmful gases, like carbon monoxide and sulfur dioxide, are belched into the air by factory smokestacks.

No matter where we live, we all have one address—PLANET EARTH—and people are slowly destroying it. We have to stop destroying Earth. If we lose this home, where will we go?

A STORY OF DESTRUCTION AND REBIRTH

Each year, more than four million acres of American forests are destroyed by fire.

Most of the plant life is destroyed. Many animals die; others flee.

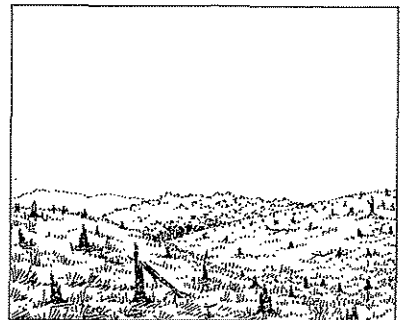


Nothing is left but ashes and black skeletons of what were once living trees.

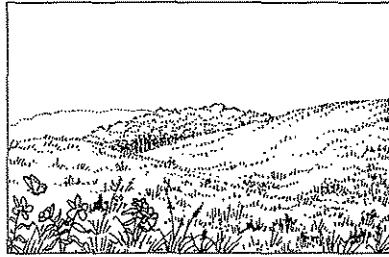
The forest community is gone. . . . But it will not stay that way. Many changes will take place to restore the forest. But it will take many years. . . .



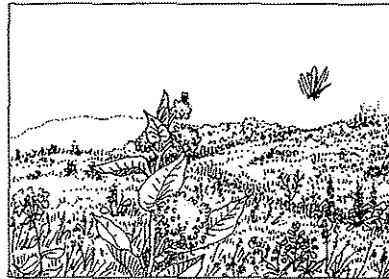
1. First, grasses and weeds grow. They grow well. There are no trees to block the sunlight.



2. These plants mature and form seeds. The wind spreads the seeds. Soon, a meadow forms. Small animals, like insects and birds, return to the area.



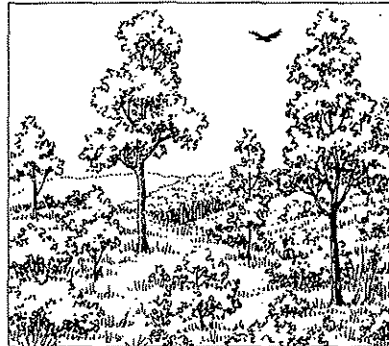
3. Many growing seasons pass. The weeds, grasses, and insects add minerals to the soil. The soil becomes richer.



4. The soil can support shrubs and small, fast-growing woody trees. These plants block the sun from the grasses and weeds. Other plants, like ferns, do not need full sunlight. They grow where the grasses and weeds once were.



5. The soil becomes richer. Taller, slower-growing hardwood trees grow. Other animals move in—like rabbits, chipmunks, and squirrels. Maybe even deer.



The area is now fully developed. It is a forest again. No new plants or animals will move in. Only "normal" forest changes will take place.

COMPLETING SENTENCES

Complete the sentences with the words below. Two of these words may be used twice.

sulfur dioxide
people
toxic chemicals
faster
floods
die out
changing

earthquakes
carbon monoxide
severe storms
balance
raw sewage
fires

volcanic eruptions
radioactive wastes
natural
droughts
polluting
upset

1. Our planet is always _____.
2. Some changes are _____; others are caused by _____.
3. Change can _____ the _____ of nature.
4. Some natural events that can upset nature's balance are _____,
_____, _____, _____,
and _____.
5. Lightning and human carelessness can cause _____.
6. People cause destructive changes in the environment by _____ the air,
water, and land.
7. Some examples of pollution caused by people are _____,
_____, _____, _____, and
_____.
8. Nature tries to keep the environment in proper _____.
9. People may upset nature's balance _____ than nature can repair itself.
10. If nature's balance is upset too greatly, many organisms will _____.

REACHING OUT

The steps below describe the destruction and rebuilding of a forest ecosystem. Place the steps in the proper order. Notice that one of the descriptions appears twice.

- | | |
|--|--|
| ☐ shrubs and fast-growing short trees | ☐ small birds and insects |
| ☐ chipmunks and rabbits | ☐ forest |
| ☐ meadow | ☐ ferns |
| ☐ dead forest | ☐ fire |
| ☐ grasses and weeds | ☐ slow-growing, tall hardwood trees |
| ☐ forest | |

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____

7. _____
8. _____
9. _____
10. _____
11. _____

WHAT IS CONSERVATION?

20



natural resources: all of the things we get from the environment

renewable resources: natural resources that are replaced by nature

non-renewable resources: natural resources that are not replaced by nature

conservation: the wise use of natural resources

Think about your pantry. It contains many kinds of foods. When they run low, you replace them. But what if you knew that you *could not* replace certain items? What would you do?

You would try to make them last as long as possible. You would use them sparingly, or conserve them. Conserve means to protect from being used up.

Earth is like a huge pantry. It has all the things we need to stay alive. It is also stocked with things that modern people use, like ores for metals and fuels for energy. All of the things we get from the environment are called *natural resources*.

There are two main groups of natural resources—*renewable resources* and *non-renewable resources*.

- Renewable resources are replaced by nature. For example, oxygen, plants and animals, and water are renewable resources. Oxygen is made by plants during photosynthesis. Plants and animals reproduce themselves. Water is renewed through the water cycle.

- Non-renewable resources are not replaced by nature—at least, not in a reasonable period of time. Fossil fuels, such as oil, coal, and natural gas are non-renewable resources. So are ores that give us metals. How would your life be different without fossil fuels and metals?

At one time, our supply of natural resources seemed endless. Now, we know differently. The population of the world is increasing. We are using more, wasting more, and polluting more natural resources than we did in the past.

Earth's "pantry" is limited. We must use our resources wisely. If we don't, there will not be enough resources left for future generations.

AREAS OF CONSERVATION

The wise use of our natural resources is called *conservation*. Some areas and methods of conservation are outlined on pages 165 through 169.

I. SOIL CONSERVATION

It takes nature from 500 to 1,000 years to produce about two and one-half centimeters (one inch) of topsoil.

Soil can be carried away by wind and moving water. This removal of soil is called *erosion*. Erosion can be reduced.



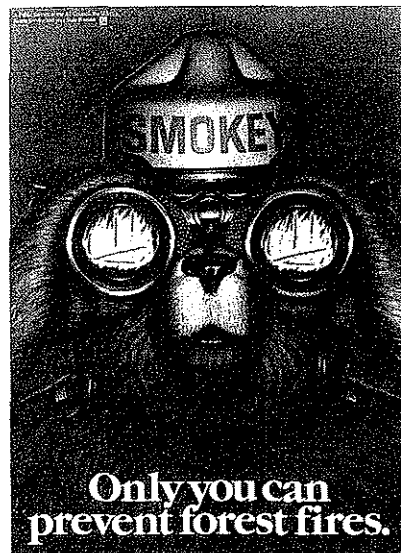
Some ways to conserve soil are:

- cover the soil with plants such as grass or shrubs,
- restrict the cutting down of forests,
- add materials like humus or fertilizers to the soil, and
- plow farmland properly.



II. FOREST CONSERVATION

Forests are "home" for many plants, animals, and protists. Forests provide us with oxygen, lumber, wood pulp, and many other products. Wood pulp is used to make paper—like the pages of this book.



Fires caused by human carelessness destroy many forests. Public education about the dangers of forest fires is one way to help conserve forests.

Other methods of forest conservation include:

- a) planting new trees to replace those that have been chopped down for lumber or other products,
- b) chopping down only certain parts of a forest to allow seeds from remaining trees to provide replacements, and
- c) removing only older or unhealthy trees from forest regions.



III. WILDLIFE CONSERVATION

All wild plants and animals are considered *wildlife*. Wildlife are part of nature. They provide us with food, clothes, and many other products. Wildlife are also pretty to look at.



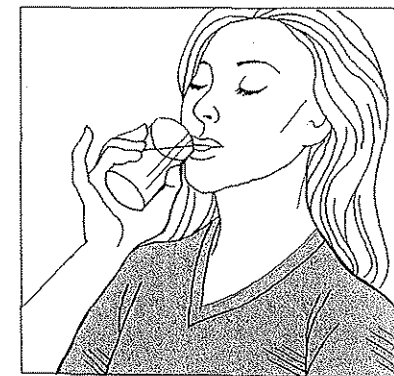
Human carelessness can cause many forms of wildlife to become extinct (die out). We pollute and overhunt. We destroy wildlife habitats for construction and mining. These things disturb nature's balance.

Some methods of wildlife conservation are:

- a) protecting the habitats of organisms,
- b) enforcing strict hunting and fishing laws,
- c) providing organisms with food in the winter, and
- d) providing special "breeding grounds" for endangered (organisms in danger of becoming extinct) species.

IV. WATER CONSERVATION

The average person drinks about 228 gallons of water each year. But water is used not only for drinking. We use it in many other ways. For example, we use water for bathing, swimming, cleaning, cooking, gardening, and boating.



Water is also vital for proper sewage disposal, industry, agriculture, and aquaculture. This list could go on and on.

Our water supply must be kept fresh and safe to drink. We must stop dumping wastes and raw sewage.

V. AIR CONSERVATION

Air pollution is very bad in most industrial areas and cities. But, air pollution spreads everywhere. It reaches every place on Earth.

Polluted air can smell bad. It can cause health problems, like respiratory diseases, lung cancer, and allergies. Polluted air also kills trees and reduces food crops.

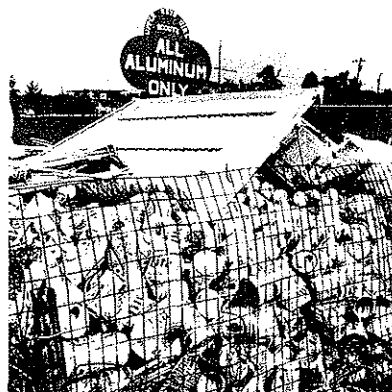


Motor vehicles and factories are the major causes of air pollution. Strict laws concerning air pollution must be passed and enforced.

What laws would you suggest to help cut down on air pollution? _____

VI. METAL CONSERVATION

To recycle means to "use over again." A jacket or sweater that has been handed down from an older sister or brother is being recycled.



Some resources, like metals, can be recycled. Metals can be melted down and re-used. Most can be recycled over and over again. Recycling is an important way to conserve metals.

VII. FUEL CONSERVATION

Fuels are non-renewable resources. Once a fuel is used, it is gone. It cannot be recycled. The best way to conserve a fuel is not to waste it. Use it sparingly. Use it as you would a non-replaceable item in your pantry.

MULTIPLE CHOICE Circle the word or phrase that best completes each of these statements.

1. All the things nature gives us are called (pantries, ores, natural resources).
2. The things that nature replaces in a short period of time are called (renewable resources, non-renewable resources, fossil fuels).
3. An example of a renewable resource is (coal, aluminum ore, the oxygen in the air).
4. Things that nature does not replace in a reasonable period of time are called (renewable resources, non-renewable resources, pollution).
5. An example of a non-renewable resource is (the population, air, an ore).
6. The wise use of our natural resources is called (recycling, consideration, conservation).
7. Dumping chemicals and untreated sewage into rivers and streams causes the water to become (polluted, extinct, conserved).
8. The use of resources over and over again is called (erosion, cycling, recycling).
9. Planned recycling is most important for (non-renewable resources, renewable resources, pollution).
10. An example of a natural resource that cannot be recycled is (iron, aluminum, a fossil fuel).

MATCHING

Match the two lists. Write the correct letter on the line next to each number.

- | | | |
|----------|-------------------------------|----------------------------|
| 1. _____ | water, air, land, and animals | a) wise use of resources |
| 2. _____ | ores, fossil fuels | b) cause of most pollution |
| 3. _____ | conservation | c) non-renewable resource |
| 4. _____ | pollution | d) renewable resources |
| 5. _____ | people | e) harms all living things |

**REACHING
OUT**

Make a list of five things you use often. Identify the natural resource (or resources) that each of the things you listed came from.

ITEM	NATURAL RESOURCE (S)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____